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ABSTRACT

The University of Puerto Rico Medical School conducted six-month Physician Retraining Programs (Curos de Perfecionamiento) for two groups of foreign trained physicians starting in the Summer of 1970 and the Spring of 1971, respectively. The characteristics of the 84 participants in these programs are examined in terms of pre-Curso medical knowledge and licensing indices and academic potential; Curso achievement indices; and post-Curso medical knowledge and licensing indices. Findings indicate that the physicians in the two programs: (1) were essentially equivalent prior to Curso participation; (2) showed significant but differential gain during the programs; and (3) performed somewhat better on subsequent Puerto Rico licensing examinations than a group of foreign-trained physicians from the general population. All indications, therefore, suggest the success of the Curso in improving the medical knowledge of participants and improving the likelihood of their subsequent licensing (and thus better utilization in a sparse health manpower pool). (Author)

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Impact of the Curso de Perfeccionamiento: An Audit of the Effectiveness of the Physician Retraining Program at the University of Puerto Rico

FINAL REPORT FOR CURSOS 1 AND 2

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February 1973

EDUCATIONAL TESTING SERVICE
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FINAL REPORT FOR CURSOS 1 AND 2

INTRODUCTION AND OVERVIEW

In 1969, the Medical School of the University of Puerto Rico (UPR) entered into a contract with the National Center for Health Services Research and Development (HSRD), Public Health Service, U. S. Department of Health, Education, and Welfare to plan and conduct a retraining program for physicians who had failed, on one or more attempts, to pass the licensing examinations of the Puerto Rico Board of Medical Examiners. (Such physicians were found to be, in every case, graduates of foreign medical schools.) Educational Testing Service (ETS) was retained by the Medical School, under sub-contract, for a variety of support activities which fall into two categories: (1) services to the administrative staff and faculty that might facilitate the planning, selection of physicians for retraining, or the effective conduct of the retraining program (including improving opportunities for internal evaluation and refinement of the activity); and (2) "third-party" evaluation of the impact of the program.

The purpose of the present report is not to inventory the services under the first category of support activities by ETS. (That has been done, in part, by a previous formal report by ETS dated June 30, 1970, and filed with the HSRD Project Officer and the UPR Project Director; and also in great detail in the periodic progress reports of the UPR Project Director.) Rather, the present report is a formal presentation of the

accumulated evidence to date of the quality and impact of the federally-supported retraining activity, covering the evaluation of the first and second offerings of the special training course.

Two training programs of approximately 6 months duration, labeled the "Curso de Perfeccionamiento" (or enrichment course), were offered in succession: the first over the period from July 1970 to December 1970, and the second from March 1971 to August 1971. (A third "Curso," supported now within the regular budget of the Medical School, has just been completed, and its evaluation will be the subject of a subsequent report.) Our purpose is to summarize the naturally-available or specifically-collected evidence as to (a) the availability of candidates for retraining, (b) the acceptability of the rather strenuous retraining program designed for them, (c) the program's impact in terms of measurable gains in medical knowledge, and (d) in terms of subsequent success in obtaining a license to practice. (Performance upon entering practice is the subject of a separate, complex, and yet incomplete inquiry by ETS and UPR faculty and staff, and is not reported at this time.)

The Need and the "Market"

It had been observed by the initiators of the retraining program at UPR that there resided in Puerto Rico a large number of graduates of foreign medical schools who appeared willing or anxious to practice on the Island, but who had failed to attain licensure. It was also observed that the shortage of practicing physicians in rural areas of Puerto Rico was particularly acute.

The initial examination of the records of the Puerto Rico Board of Medical Examiners, covering a ten year period through April 1969,

revealed the names of 220 physicians who had never achieved licensure--and who had, on from one to fourteen attempts, failed the licensing examinations. The September 1969 licensure administration added another 41 physicians in this category. Thus, on the eve of the first Curso, there appeared to be available a pool of 261 medical school graduates interested in practicing in Puerto Rico but unable to obtain a license for practice.

An initial activity was the construction of a biographical and training preference questionnaire for this target group of physicians. This was mailed to the group of 261 in December 1969. Natural shrinkage -- physicians moving and leaving no forwarding address, death or retirement, or licensing via another route -- brought the available pool down to 217. By the end of February, 139 physicians had returned questionnaires -- as had 103 of their spouses.

The results of this survey were included in a brief report of April 10, 1970, and in a detailed report dated "Spring 1970," filed with the UPR Project Director and the HSRD Project Officer. Highlights for the present purpose, however, may be summarized very briefly.

First, all but eight of the 139 responding physicians stated an interest in receiving retraining. Further, almost three-fourths were currently residents in Puerto Rico, and more than half expressed a positive interest in practicing in Puerto Rico (with many not responding to that question). Almost all stated an intent to try for licensure again. The most frequent preference for later activity was practice or service in a government hospital. Very few expressed unwillingness to serve a special assignment in a critical health care need area in Puerto

Rico, and their spouses, as determined from the separate questionnaire, supported this interest in retraining.

Second, this portion of the pool of unlicensed physicians revealed these characteristics: substantial experience (the median number of years of previous medical practice elsewhere was 10); most frequent practice in general medicine, internal medicine, surgery, or obstetrics/gynecology; median age, 44; origin about equally divided between Cuba, the Dominican Republic, and Puerto Rico (the latter group had completed medical school in other countries, principally Spain); and, origin principally from comfortably well-to-do families living in cities of 50,000 or more.

In sum: there seemed indeed to be an available pool of physicians for retraining. A substantial number of that pool expressed interest in the retraining opportunity, were it to be presented, and an inclination to practice in Puerto Rico, if retraining contributed to success in attaining a license.

Success in Filling the Curso, and Subsequent Licensing History

Stating interest in a retraining opportunity is one thing; taking on a strenuous six-month program, with consequent disruption of other activity, and physical, if temporary, move to San Juan necessitated in most cases, is another thing.

The decision to proceed with the first Curso was confirmed April 1970, with that program to begin almost immediately in July 1970. The staff was able to select and enroll their self-established goal of 50 physicians. Of that group, 47 proceeded through the Curso

(one died and two withdrew) and 44 sat for the Medical Boards in December. (The three who did not take the examinations were resident aliens, who had not lived in Puerto Rico for a sufficiently long period to qualify to take the examination.) Their performance on the Licensing Exam, by parts, was: attempted complete Part 1 (Basic Sciences), 38, with 15 passing; attempted complete Part 2 (Clinical), 38 with 28 passing. Requirements for licensure of U.S. citizens and foreign nationals vary, however. At the end of the licensing board action, and in accordance with the differential requirements, 33 physicians from the first Curso received some form of license. Of those who did not, three of the four who attempted the examination did obtain a license on the following licensure examination in March 1971, including 2 of the 6 physicians receiving Provisional license earlier who obtained permanent licensure on the March 1971 examination. The general flow of the physicians through the first Curso and the two subsequent examinations is given in Figure 1 on the following page.

The second Curso, begun March 1971, attracted and enrolled 34 physicians, of whom 7 were from the first Curso but whose first post-Curso licensing attempt had been unsuccessful. For this group, 32 of the physicians completed the Curso and took the Boards, with 18 approved for either a Regular or a Special license. Another 5 received a Provisional license. Of the 14 participants who either did not pass the first post-Curso licensing or received a Provisional license, 5 attempted the subsequent licensing examination, and 2 of them were approved for practice with one or another kind of license. The general flow of the physicians through the second Curso and the two subsequent examinations is shown in Figure 2.

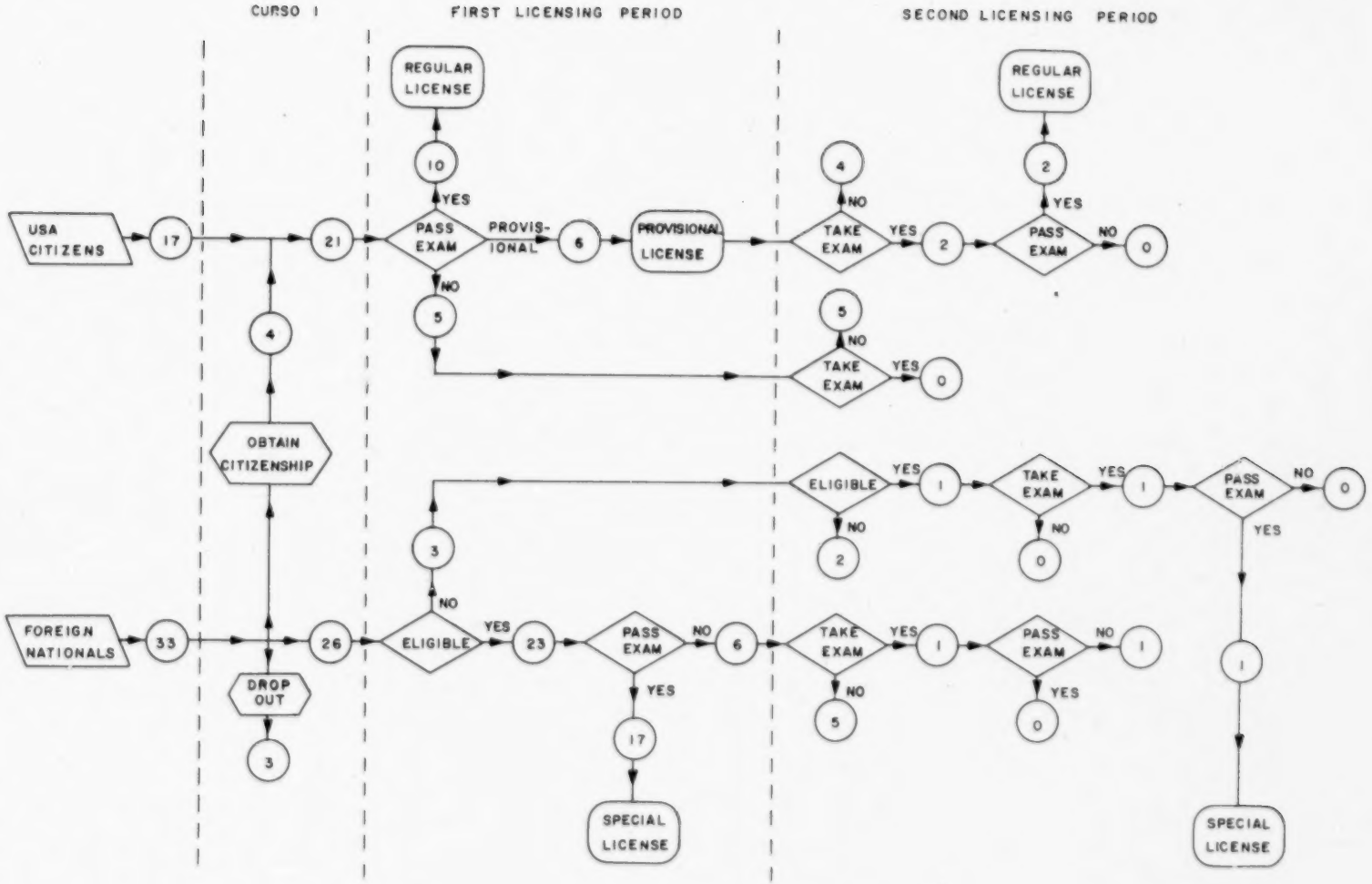

Figure 1: Flow of physicians through Curso 1
and the two subsequent Licensing Examination periods.

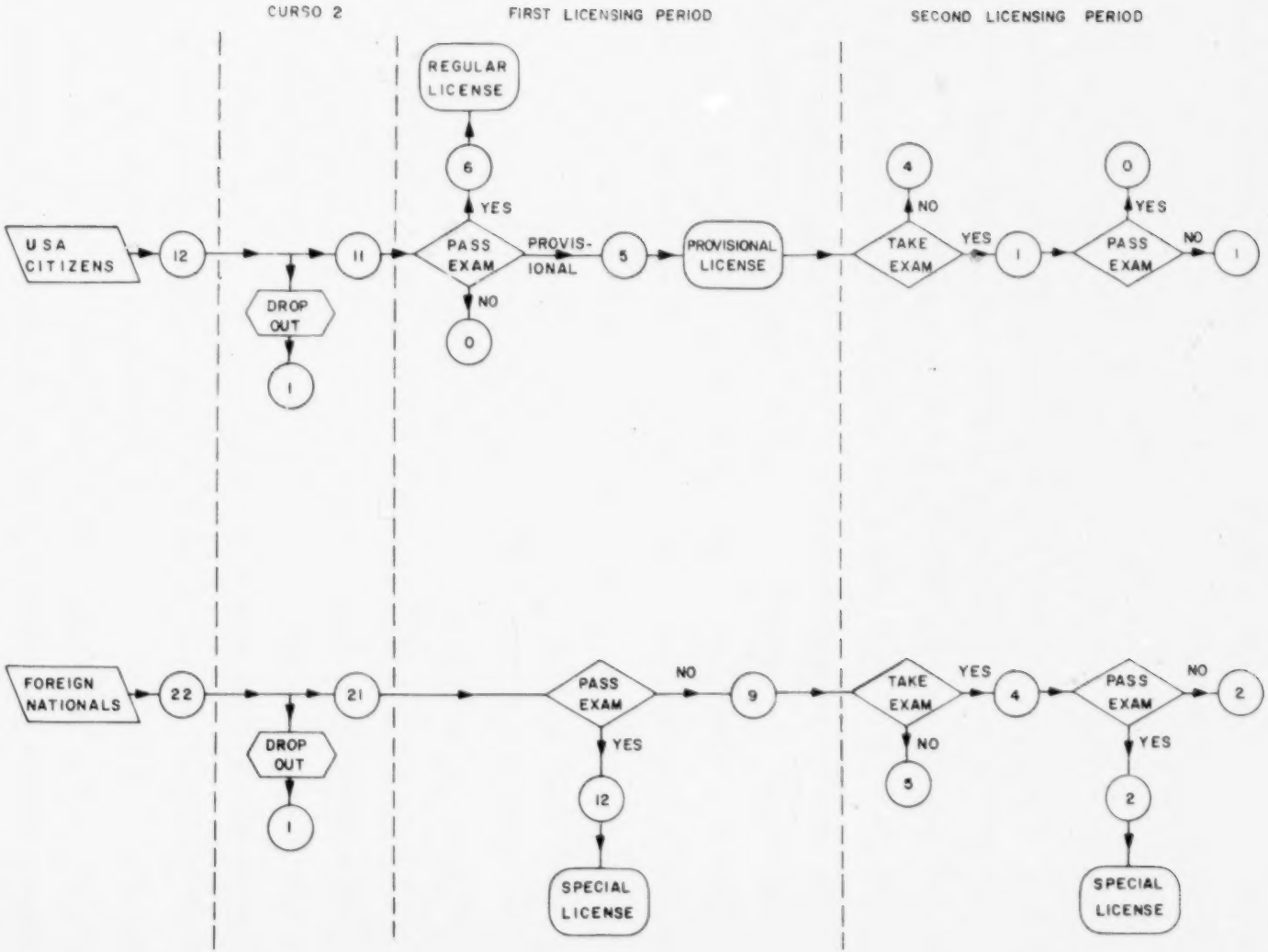

Figure 2: Flow of physicians through Curso 2
and the two subsequent Licensing Examination periods.

The most direct and obvious implication of this history is that the Cursos, offered for six months each year (approximately), have been sufficiently attractive that from 34 to 50 physicians have been selected and induced to undertake the retraining opportunity.

A second implication is that there are now practicing (or available for practice) 58 additional physicians who have gone through the Curso. (One from Curso 1 who failed the Boards following that Curso was subsequently reexamined and approved.) This is not particularly good evidence of impact of Curso, however. One needs to know what the typical experience is for physicians retaking the State Boards, as a gauge for examining the similar experience for the Curso physicians; further, one needs to calculate this experience in terms of number of previous failures on the Boards. Beyond this, it would be desirable to break down the group into U.S. citizens or aliens, and consequent Board requirements and type of licensing options, but at this point it becomes quickly apparent that considering all the data cells -- pass vs. fail, number of previous attempts (which also must be subdivided, as many physicians sit first for one part, then another or all of the examinations), citizenship, and kind of license -- the total of 81 Curso 1 and 2 participants provides too small a number for meaningful comparisons.

As an attempt to focus on the most critical aspects, we have examined the numbers of physicians passing or failing each part (basic medical science vs. clinical areas), and have, from that record, computed a probability of passing the post-Curso Board. Taking the two parts of the Boards and the two Cursos separately: 41 physicians in Curso 1 took Part 1, (Medical Science area) with 18 or 44% passing; 39 physicians took Part 2, (Clinical area) with 24 or 62% passing. For Curso 2: 30 physicians took Part 1, with 9 or 30% passing, and 31 took Part 2, with 20 or 65% passing.

Similar data collected for "physicians in general" who graduated from foreign medical schools are presented together with that for the Curso participants in Table 1. This takes into account the number of times specific parts of the Licensing Examination had previously been taken. With the exception of those physicians taking Part I of the Examination for the first time, Curso participants compare quite favorably with "physicians in general." (It should be recalled that non-citizens are not required to take Part 1 of the Licensing Examinations.)

The Experimental Assessment of Impact of the Curso Experimental Variables:

An early effort in the preparatory activities of the Medical School and of ETS was the development of twelve tests of medical knowledge, a Spanish language scholastic aptitude test, and a test of ability to understand scientific material presented in written English. The twelve medical knowledge tests were developed, through standard ETS procedures, using faculty of the Medical School to establish specifications and write items (after training). Technical and editorial review reduced the number of items to 40 for each medical knowledge test. Topical content of these tests is: in the basic medical sciences -- anatomy, physiology, pharmacology, microbiology, biochemistry, and pathology; and in the clinical areas -- general medicine, pediatrics, psychiatry, community health, surgery, and obstetrics/gynecology.[1]

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[1] No formal analysis of the technical reliability of these tests was made. Standard item analyses were conducted, however, and reveal a good range of item difficulty and a high degree of internal consistency.

TABLE 1

PROPORTION OF PHYSICIANS APPROVED, BY SUB-EXAMINATION, ON FIRST POST-CURSO LICENSING EXAM FOR CURSO 1 AND CURSO 2 PARTICIPANTS

	Curso Number			Base Rate**	
	1	2	Combined		
Part I					
# of Times Licensing Exam Was Taken Previously					
0	9/25=.36	2/14=.14	11/39=.28	(p<.001)*	.63
1	6/8=.75	4/7=.57	10/15=.67	(p<.10)*	.44
2	1/3=.33	2/4=.50	3/7=.43	NS*	.46
3 or more	2/5=.40	1/5=.20	3/10=.30	NS*	.24
TOTAL	18/41=.44	9/30=.30	27/71=.38		.55
Part II					
# of Times Licensing Exam Was Taken Previously					
0	6/8=.75	---	6/8=.75	NS*	.59
1	12/21=.57	3/5=.60	15/26=.58	NS*	.52
2	2/3=.67	11/14=.79	13/17=.76	(p<.005)*	.42
3 or more	4/7=.57	6/12=.50	10/19=.53	(p<.10)*	.34
TOTAL	24/39=.62	20/31=.65	44/70=.63		.54

* Test of significant difference from base rate proportion, using a one-tailed binomial exact test.

** Base rate established for all foreign trained physicians taking licensure examinations over a period from March 1959, through April 1972.

The general design of the inquiry, then, was to administer the fourteen tests to Curso applicants just before the Curso began; then, in the final week of the Curso, to repeat the twelve medical knowledge tests, toward determining if significant gains had occurred. Also relevant, of course, are any "grades" or evaluations made by teaching faculty in the progress of the Curso.

For each Curso, the following potential matrix of variables becomes available:

1. Scores (or averages) on each of nine pre-Curso licensing examinations (the eight tests previously described, plus a "practical examination");
2. Scores on the twelve pre-Curso medical knowledge tests, the scholastic aptitude test (yielding a verbal, quantitative, and total score), and the English comprehension test;
3. One or more instructor-derived evaluations of performance within the Curso;
4. Scores on the twelve post-Curso medical knowledge tests;
5. Scores on the nine post-Curso licensing examinations.

In addition, of course, other variables can be derived from summations of scores -- for example, the nine licensing examinations can be translated into a single pass/fail score -- or, from differences in pairs of variables -- for example medical knowledge or licensing reexamination gain scores.

Thus, there exists a minimum of 45 different variables on each Curso group. One statistical hazard of using all -- even if in sub-sets for different purposes -- is, of course, that we have more variables than

people. Another is that there are built-in unavoidable interrelationships among the test variables. In the series of analyses conducted, ultimately the relationship of every variable to every other variable was determined, under the strategy that thorough search for tentative trends might be more useful than more general analyses of less speculative summations. Data from the complete correlation matrices are presented in the appendices, and their most important implications may be summarized below. It should be noted that these implications are not results of rigorous statistical analyses, but rather suggestions from the available data.

1. With regard to selection: the preliminary data analyses indicated that there are sufficient relationships between the pre-Curso versus the post-Curso measures to permit selection of (a) those most likely to do well on separate Medical Knowledge Tests administered after the Curso; and (b) those most likely to do well in the Curso as measured by quizzes administered in the Curso; or (c) those most likely to achieve licensure, or to achieve a passing score on the individual licensing examinations (with the exception of the Obstetrics licensing exam -- see Appendix A and Appendix B).
2. Although the relationships are not high, those who improved their score the most on the readministration of the Medical Knowledge Test were those with the lowest scores on the pre-test (this group of course has more room for improvement). Those most likely to obtain the higher scores on the post-test -- or on the licensing exams -- were, in general, those with the

higher scores on the pre-test battery (a typical finding in a test-retest situation).

3. With regard to effectiveness of the Curso: first, there is some evidence, from the analysis of those who improved the most between pre-test and post-test, that the Curso was most effective with the lower ability or poorer performing physicians. There is also a suggestion in the data that the more pragmatic (as opposed to those oriented to fact and theory) profited more from instruction (i.e.,those who do well in the clinical area as opposed to medical science area prior to the Curso, tend to improve more in both areas).

4. In general, however, the measures used during the Curso seem reasonably well related to the content of the Medical Knowledge Tests, both pre-Curso and post-Curso, which was a somewhat separate but thoughtful specification of what a physician should know.

5. The measures used during the Curso (reflected in the quizzes) do not seem to be significantly related to passing versus failing licensing. They are, however, related to a number of the separate licensing areas. It is considerably distressing that the best outside criterion -- passing the medical boards -- has a low relationship to the midterm tests, but rather clearly no relationship to the all-quiz average or number of quizzes passed. The suggestion is that whatever the students were evaluated on after instruction in the various instructional blocks is not related to passing licensure exams.

6. There is a high positive relationship between the Verbal Aptitude, English Reading, and Total Medical Knowledge pretest score on one hand and the average on the Curso quizzes (e.g., the predictor variables cited can be used to identify with a high degree of accuracy those who will perform well on criteria invoked by the Curso instructors).

7. Of larger import: Scores on the Medical Knowledge Pretests are significantly related to passing licensure (this relationship is developed much more rigorously in a following section).

8. Taking the separate Medical Knowledge Pretest scores, all but one (Community Health) have negative relationships to the Total Gain score (a score representing a simple sum of all Post-Pre differences). The scores on Physiology, Pathology, General Medicine, Pediatrics, and Psychiatry in particular seem to have substantial negative relationship to the Total Gain score. In other words, those who improved the most from pre-test to post-test appear to be those with higher scores on Community Health and lower scores on the five other areas in particular.

9. Taking the separate Medical Knowledge post-test scores, most have low but positive relationship to the Total Gain score, as would be expected (e.g., those scoring high on the separate post-tests tend to make higher Total Gain scores). However, Community Health again appears to stand out in some special way against the Total Gain score: there is a high relationship between Community Health post-test score and Total Gain score.

What these data mean, with regard to the Community Health test,

is uncertain. The content of that test seems to be more judgmental and problem solving, and less factual in nature than the other tests. It may be performing a subtle role in identifying a personal trait or personality style that is associated with improvement in medical knowledge (through the Curso experience) generally. (With positive relationship for both pre-test and post-test Community Health vs. Total Gain, it is not plausible to say the Total Gain accrued because of a good coverage in the Curso of the Community Health area.)

The Experimental Design for Study of Curso Impact

Some of the interpretations from the data mass just cited have implications for problems other than assessment of impact of the Curso, which is, of course, the basic objective of this report. Toward that basic objective, we have selected, as the most frequently available, consistent, and reliable data frame for that purpose (1) that deriving from the before/after administration of the medical knowledge tests, and (2) that deriving from the examination of scores on the pre-Curso vs. post-Curso licensing examinations.

Using these two sets of before-after measures, two important questions must be raised. The first -- as two Curso groups are involved, and as these could differ in initial level of promise (and further, as modifications in staff, schedule, and curriculum were made after Curso 1): Are the two groups of physicians (Curso 1 and Curso 2) similar or different in (a) level of promise as revealed by pre-Curso variables, or in (b) pre-Curso/post-Curso gains? The answer to this question tells us

(a) where the two groups may be combined (to yield a larger number for and greater reliability to the analyses), and/or (b) if there were important differences (and if so, their probable origin -- in student or in course characteristics) in impact of the two Cursos.

The second important question, once the prior question is answered, is: Are there significant evidences of gains between the time the Curso began and the time it concluded?[2]

The statistical procedures employed, and the results, are presented in the next section of this report.

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[2] An important limitation of the design, imposed for practical and cost reasons, is the absence of a "control group." Any gains found may be those that would normally occur from self-study, the experience of prior testing, the tendency for scores to be error-infested and regression toward the mean "true" score on second testing, etc.

ANALYSES AND RESULTS

As specified in the previous section, the data collected for both Curso groups lend themselves quite naturally to grouping into five variable sets. These variable sets can be labeled as follows: (1) Pre-Curso licensing scores; (2) Pre-Curso testing variables (including the two aptitude measures, English reading, as well as the twelve UPR medical knowledge tests); (3) Course scores (the various measures taken on Curso participants during the Curso proper, measures which differ substantially in content from Curso 1 to Curso 2); (4) Post-Curso Testing Variables (the twelve medical knowledge tests); and (5) Post-Curso Licensing Variables. Raw score means and standard deviations for these five variable sets as well as tables showing intercorrelations between and within variable sets have been previously discussed and are given in Appendices A and B; Appendix A showing the results for Curso 1 and Appendix B showing the results for Curso 2. It should be noted at this point, in relation to the statistics reported in Appendices A and B, that in neither Curso were all measures available for all Curso participants. For descriptive purposes, this problem of "missing data" has been approached by using all available data to compute the various descriptive statistics. For this reason, the number of cases contributing to a given statistic will vary. For means and standard deviations, specific numbers contributing to each statistic are given; however, in the intercorrelation tables only the minimum and maximum values of N are given. While the careful reader will certainly find interesting and suggestive patterns of correlation presented in these two appendices, some of which have been mentioned previously, we shall not pursue at this point any further interpretation of such patterns. Such interpretation would be clouded as previously noted by (1) the "missing

values" problem (which in some cases is quite marked), and (2) the extremely large number of variables relative to the sample size. Both of these problem areas serve to reduce the stability of patterns in the findings which were discussed in some detail in a previous section.

Differences Between Curso Groups

Before asking the question of whether or not the Curso students made significant gains, a natural prior question needs attention. Specifically, do the groups of the two Cursos differ in terms of logically related sets of variables common to the two Cursos? The variable sets that suggest themselves for grouping are: (1) ability (cognitive) variables as measured by the Verbal and Mathematics Tests and the English Reading Test; (2) medical knowledge prior to the Curso, as measured by the pretesting on the 12 Medical Knowledge Tests; (3) medical knowledge after the Curso, as measured by the post-testing on the 12 Medical Knowledge Tests; (4) most recent Licensing Sub-Test scores prior to the Curso; and (5) Licensing Sub-Test scores on completion of the Curso. Since in all 5 instances we are dealing with sets of variables, an appropriate statistic is the Multivariate Analysis of Variance (MANOVA). MANOVA is described in some detail by Morrison (1967) and Anderson (1958). Loosely speaking MANOVA allows the researcher to test differences between 2 or more groups on an entire set of variables, simultaneously. The particular program used for the analyses reported below is that developed and described by Clyde, Cramer and Sherin (1966). It should be noted that the means and standard deviations presented in this section will not necessarily be the same as those given in Appendices A and B. The reasons for the discrepancies is that MANOVA requires no "missing data" for any

case on any of the variables; thus those Curso participants, for whom scores are not available on as few as one of the variables of a particular analysis, must be excluded from that analysis. Further, the participants of Curso 2 included 7 participants of Curso 1 who failed the Medical Licensing exam following Curso 1 and subsequently "reenrolled" in the Curso de Perfeccionamiento. While these "repeaters" can be reasonably included in the results for Curso 1, they may represent a somewhat different group than those other participants in Curso 2. For this reason, they have been excluded from any analyses in which their exclusion has led to markedly different results (they have been included in the computations of descriptive statistics in Appendix B).

Means and standard deviations of the ability variables by Curso group are given in Table 2. While these data indicate consistently larger means and standard deviations for the first Curso participants,

TABLE 2

MEANS AND STANDARD DEVIATIONS FOR ABILITY VARIABLES

Curso Number		Test Verbal	Math	English Reading
1	Mean	25.6	9.9	12.0
N=44	S.D.	11.3	3.9	7.4
2	Mean	24.4	8.8	11.3
N=33	S.D.	10.1	3.4	5.8

those differences do not approach statistical significance, either singly (by Univariate Analysis of Variance) or collectively (by MANOVA). There is, thus, no indication that either of the two Curso groups started training with greater ability (Verbal or Mathematical) or with an advantage in English reading.

Means and standard deviations of the pre-testing with the 12 Medical Knowledge Tests are given in Table 3. In general the second Curso group has slightly larger mean scores and slightly smaller variability; however, the statistical test indicates that the groups do not differ significantly on this set of variables when taken collectively. The Curso difference on the single variable Microbiology (Univariate Analysis of Variance) is significant at the .05 level ($F = 3.996$). In other words, there is no indication that either of the two Curso groups started training with an advantage in medical knowledge with the possible exception of Microbiology.

In examining the full set of most recent pre-Curso Licensing examination scores (8 areas of medical knowledge, excluding the "practical"), there was no statistically significant difference between Curso groups when the variables were analyzed collectively as a set. For the individual comparisons of differences between Curso groups, using each Licensing area separately, the groups differed significantly ($p<.05$) only in the area of Tropical Diseases. Unfortunately, only 15 members of the Curso 1 and 15 members of Curso 2 had previously taken all eight licensing examinations prior to the Curso, a fact which seriously hampers the examination of Curso differences. Due to lack of U.S. citizen status, many of the

TABLE 3

MEANS AND STANDARD DEVIATIONS FOR MEDICAL KNOWLEDGE VARIABLES (PRE-CURSO TESTING)

		Anatomy	Physiology	Pharmacology	Microbiology	Biochemistry	Pathology	Surgery	Obstetrics	General Medicine	Public Health	Pediatrics	Psychiatry
1	Mean	14.3	13.2	17.2	13.7	16.3	15.2	11.3	19.3	15.7	15.5	17.9	15.4
N=46	S.D.	3.9	4.8	4.8	3.7	4.6	5.3	3.6	4.3	5.3	3.8	4.5	4.0
2	Mean	14.6	14.8	17.3	15.3	15.9	15.3	11.0	19.6	17.2	15.9	17.5	16.0
N=34	S.D.	4.0	4.5	4.1	3.4	4.3	4.2	2.7	4.2	3.5	3.3	4.7	4.1

Curso participants had taken only the Clinical Area Licensing Tests (for purposes of obtaining a "Special License"). Due to the reduction of sample size imposed on the analysis when the full set of 8 Licensing scores was attempted, an additional analysis was performed for the Clinical Area Licensing test scores only. The means and standard deviations on these examinations for the clinical area are given in Table 4. As can be seen in Table 4, Curso 2 participants appear to have substantially higher mean scores in the Pre-Curso Clinical Licensing areas of "Surgery" and "Tropical Diseases." The statistical analyses support this intuitive analysis. The Curso groups differ significantly ($F = 3.85$; $df = 4, 67$; $p<.01$) on the set of variables. Examining differences on the individual licensing areas shows that the differences are, in fact, statistically significant in the area of "Surgery" ($F = 8.431$; $df = 1, 70$; $p<.01$) and "Tropical Diseases" ($F = 6.904$; $df = 1, 70$; $p<.05$). A note of caution should be stressed at this point, however. Licensing prior to Curso 1 consisted of a considerably less structured and standardized procedure than that after Curso 1 (and immediately prior to Curso 2). It is therefore quite possible that the "most recent" Licensing Examination scores are not directly comparable, either within or between Curso groups. The differences, while significant in a statistical sense, may reflect only differences in "most recent" examination taken rather than actual differences in Curso participants' medical knowledge.

Means and standard deviations of the post-testing with the 12 Medical Knowledge Tests are given in Table 5. These data suggest a pattern; specifically, of the two groups which began the Curso with no noteworthy

TABLE 4

MEANS AND STANDARD DEVIATIONS FOR MOST RECENT
PRE-CURSO LICENSING EXAMINATION (CLINICAL AREA)

Curso Number		Test: Surgery	Obstetrics	General Medicine	Tropical Diseases
1	Mean	55.5	72.6	63.4	59.9
N=38	S.D.	16.0	11.7	12.7	13.6
2	Mean	65.2	71.2	63.0	67.9
N=34	S.D.	11.9	11.5	15.6	12.2

TABLE 5

MEANS AND STANDARD DEVIATIONS FOR MEDICAL KNOWLEDGE VARIABLES (POST-CURSO TESTING)

Curso Number		Test											
		Anatomy	Physiology	Pharmacology	Microbiology	Biochemistry	Pathology	Surgery	Obstetrics	General Medicine	Public Health	Pediatrics	Psychiatry
1	Mean	17.5	18.6	19.7	17.5	1).0	20.4	13.1	22.6	21.2	19.0	21.7	18.0
N=45	S.D.	3.9	4.3	3.5	3.8	4.0	5.2	3.5	4.1	4.9	3.7	5.0	4.0
2	Mean	15.9	17.9	18.8	17.7	23.6	19.6	13.4	23.9	22.1	20.2	22.0	18.8
N=33	S.D.	3.9	4.6	4.9	3.7	4.7	5.4	3.3	3.8	5.0	2.8	5.1	3.6

difference in ability or medical knowledge, the second group ended the Curso with an advantage in medical knowledge over the first group on all 6 of the clinical Medical Knowledge Tests (they were higher on only 2 of the Basic Medical Science Tests). MANOVA analyses substantiated the hypothesis of Curso group differences, as shown in Table 6. While the two Curso groups differed significantly ($\alpha = .05$) on but one of the 12 tests (Biochemistry) when considering them separately, the group differences on the entire Battery of Tests was significant at the .001 level. Separate MANOVA analysis for only the Clinical Area Tests showed no significant group differences; thus the post-Curso differences between groups can be attributed to the subset of Basic Medical Science Tests. In other words, two groups began the Curso as more-or-less equivalent on ability and medical knowledge, but these same two groups ended the Curso with statistically significant differences on medical knowledge.

This suggests, since no prior Curso group differences existed on these tests, that the amount of gain on medical knowledge is different for the two Cursos. This hypothesis is borne out qualitatively by the graphs of pre-testing and post-testing for each Curso group on each of the 12 Medical Knowledge Tests (Figures 3 and 4). The graphs suggest an interaction between group and time of testing (i.e., differential gain). To test this hypothesis quantitatively, MANOVA was applied to the gain scores for the 12 tests (cf., Cole & Grizzle, 1966). The results of the analysis are given in Table 7. Considering the tests individually, the groups differed in gain significantly ($\alpha = .05$) on three tests, Biochemistry, Anatomy, and Physiology; and in terms of the entire battery of tests, the groups

TABLE 6

RESULTS OF MULTIVARIATE AND UNIVARIATE ANALYSES OF VARIANCE FOR CURSO DIFFERENCES ON MEDICAL KNOWLEDGE TESTS (POST-TESTING)

	Degrees of Freedom for Hypothesis	Degrees of Freedom for Error	F	
Multivariate Test[1]	12	65	4.260	p<.001
Univariate Tests				
Anatomy	1	76	3.304	p<.1
Physiology	1	76	.446	---
Pharmacology	1	76	.889	---
Microbiology	1	76	.053	---
Biochemistry	1	76	21.710	p<.001
Pathology	1	76	.373	---
Surgery	1	76	.180	---
Obstetrics	1	76	2.190	---
General Medicine	1	76	.653	---
Public Health	1	76	2.556	---
Pediatrics	1	76	.099	---
Psychiatry	1	76	.807	---

[1]Test of significance using Wilks' lambda criterion.

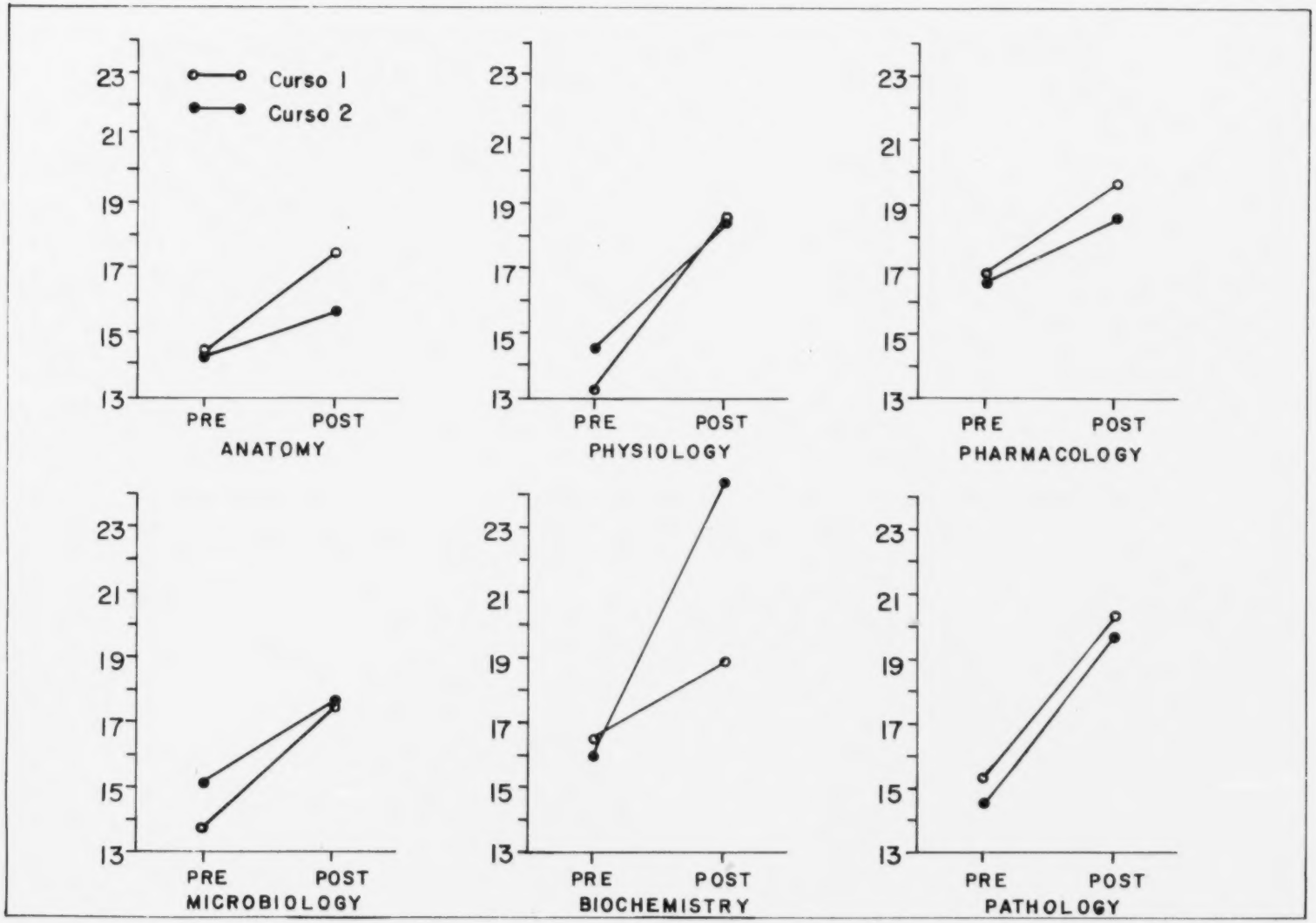

Figure 3: Gains on basic medical science tests for Cursos 1 and 2.

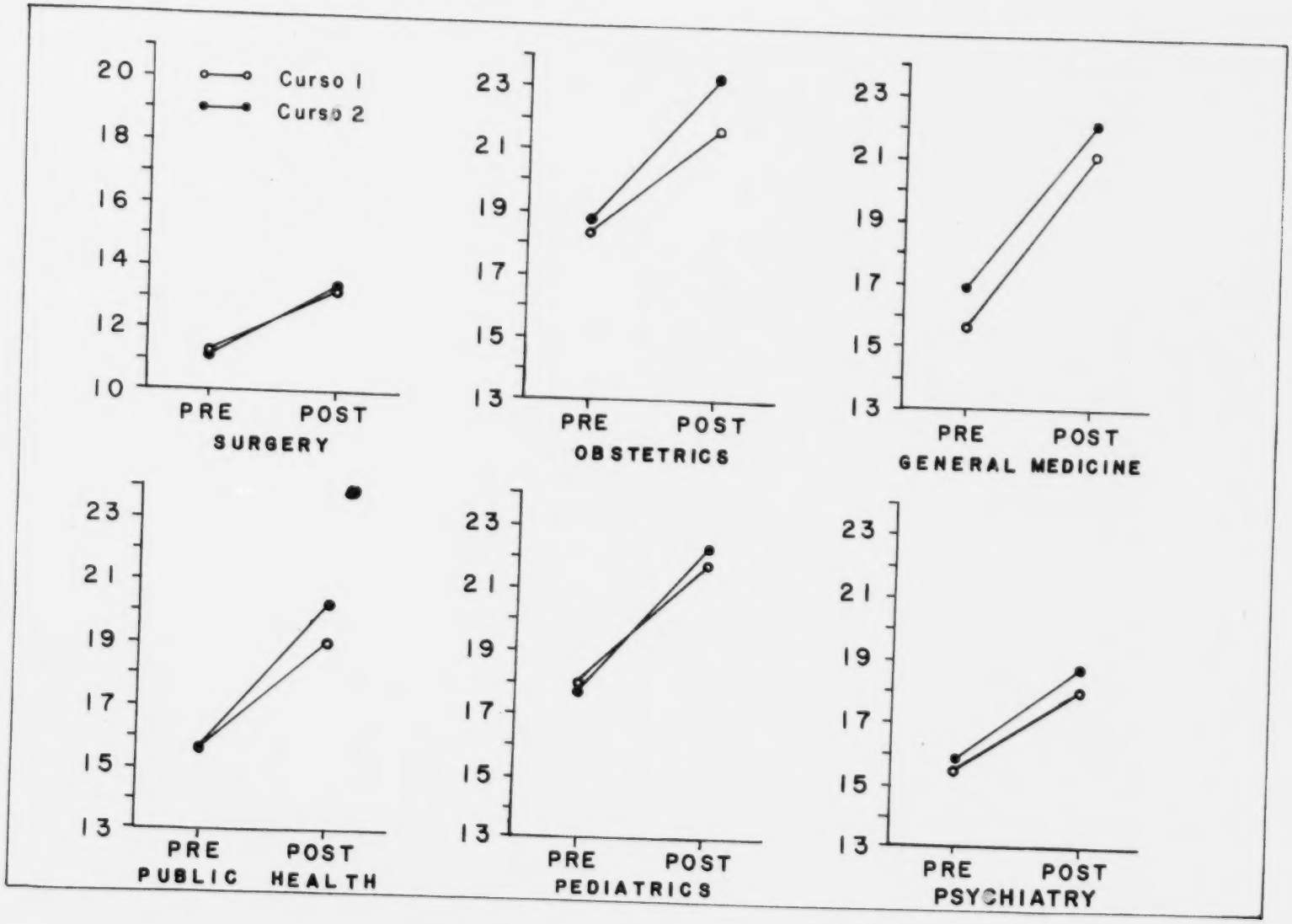

Figure 4: Gains on clinical knowledge tests for Cursos 1 and 2.

TABLE 7

RESULTS OF MULTIVARIATE AND UNIVARIATE ANALYSES OF VARIANCE FOR CURSO DIFFERENCES IN GAIN ON THE 12 MEDICAL KNOWLEDGE TESTS

	Degrees of Freedom for Hypothesis	Degrees of Freedom for Error	F	
Multivariate Test[1]	12	64	4.636	p<.001
Univariate Tests				
Anatomy	1	75	4.126	p<.05
Physiology	1	75	4.815	p<.05
Pharmacology	1	75	1.384	---
Microbiology	1	75	2.672	---
Biochemistry	1	75	24.854	p<.001
Pathology	1	75	.290	---
Surgery	1	75	.324	---
Obstetrics	1	75	.985	---
General Medicine	1	75	.871	---
Public Health	1	75	1.056	---
Pediatrics	1	75	.241	---
Psychiatry	1	75	.007	---

[1] Test of significance using Wilks' lambda criterion.

differed, in terms of gain, at the .001 level of significance. That is to say, there was a statistically significant difference in the patterns of change in medical knowledge between the two Curso groups. The nature of this difference has been previously described and is shown in Figures 3 and 4. Summatively, Curso group two gained significantly more on Biochemistry than did Curso group one, while Curso group one gained significantly more on Anatomy and Physiology than did Curso group two. Additional analyses on the subset of 6 Clinical Area Tests showed no significant Curso group differences either collectively or singly on these tests; thus, the differential gain is specifically attributable to the Medical Science Test areas.

Interpretation of these statistically significant differences is extremely difficult. Differential gains may be due to differences in actual conduct of the Curso (different instructors, different educational techniques, different work and study schedules, or even to physical differences in Curso facilities) or to differential selection procedures leading to differences in participants (to rule out these last two possibilities, the selection procedure was maintained as more-or-less the same and previous analyses have suggested few pre-Curso differences for the two groups). More sophisticated statistical approaches which mathematically control for existing group differences (Covariance Analysis) were not attempted due to small group sizes relative to the large number of variables which would need to be considered.

Table 8 shows post-Curso group means and standard deviations on the 9 Licensing Examination Sub-tests. Some rather marked differences between the two Curso groups are evident from the table. Group differences were tested quantitatively by MANOVA; the results of this test are given in

TABLE 8

MEANS AND STANDARD DEVIATIONS FOR THE TWO CURSO GROUPS ON THE LICENSING SUB-TESTS
(POST-CURSO TESTING)

Curso Number		Sub-Test: Anatomy	Physiology	Pharmacology	Pathology	Surgery	Obstetrics	General Medicine	Tropical Diseases	Practical
1	Mean	69.3	72.3	72.9	77.4	77.9	73.2	77.2	80.8	74.6
N=32	S.D.	9.8	12.1	9.9	8.5	7.3	7.7	8.0	6.0	11.4
2	Mean	56.4	75.8	71.6	75.2	68.8	84.2	78.8	80.2	77.3
N=29	S.D.	17.0	9.7	9.5	8.3	9.8	5.4	8.2	7.5	8.3

Table 9. The analyses show the two groups differing on the Battery of Licensing Sub-Tests at the .001 level of significance. Additionally, significant ($\alpha = .05$) Curso group differences exist for the individual sub-test comparisons on Anatomy, Surgery, and Obstetrics. By reference to Table 8, it is seen that these differences are attributable to the higher performance of Curso group 1 on the Anatomy and Surgery Sub-Tests and the higher performance of Curso group 2 on the Obstetrics Sub-Test. Reason for these differences may be attributable to pre-Curso differences, in some cases, or to differential Curso benefit. It should be kept in mind, however, that the two Curso groups did not take the same licensing examinations following the course, although both groups took Post-Curso Board Examination after the inception of a new series of objective-style tests (where conscious effort and technical assistance from ETS -- in a separate project--directed toward "standardizing" this procedure).

In any event, the two groups, which began the Curso more-or-less equal in ability and medical knowledge, performed differentially on the Battery of Licensing Tests administered after the Cursos. For this reason, an analysis of differential gains on licensing examinations was performed. Due to limited availability of pre-Curso licensing examination results in the Medical Science area for both Curso groups (and the great variation, presumably, in pre-Curso licensing exams), this analysis was performed only for the 4 Clinical Area licensing examinations. The differential gain on these licensing examinations is shown in Figure 5. Very marked interactions (reflecting differential gain) are evidenced in the areas of Surgery and Obstetrics, the gain being greater for Curso 1 participants in the former and for the Curso 2 participants in the latter. Further there is some evidence of greater gain for the Curso 1 group in the area of Tropical Diseases. The statistical analysis of these gains supports the

TABLE 9

RESULTS OF MULTIVARIATE AND UNIVARIATE ANALYSES OF VARIANCE FOR CURSO DIFFERENCE ON LICENSING SUB-TESTS (POST-CURSO TESTING)

	Degrees of Freedom for Hypothesis	Degrees of Freedom for Error	F	
Multivariate Test[1]	9	51	14.641	p<.001
Univariate Tests				
Anatomy	1	59	13.521	p<.001
Physiology	1	59	1.540	---
Pharmacology	1	59	.282	---
Pathology	1	59	1.096	---
Surgery	1	59	17.146	p<.001
Obstetrics	1	59	41.471	p<.001
General Medicine	1	59	.533	---
Tropical Diseases	1	59	.109	---
Practical	1	59	1.135	---

[1]Test of significance using Wilks' lambda criterion.

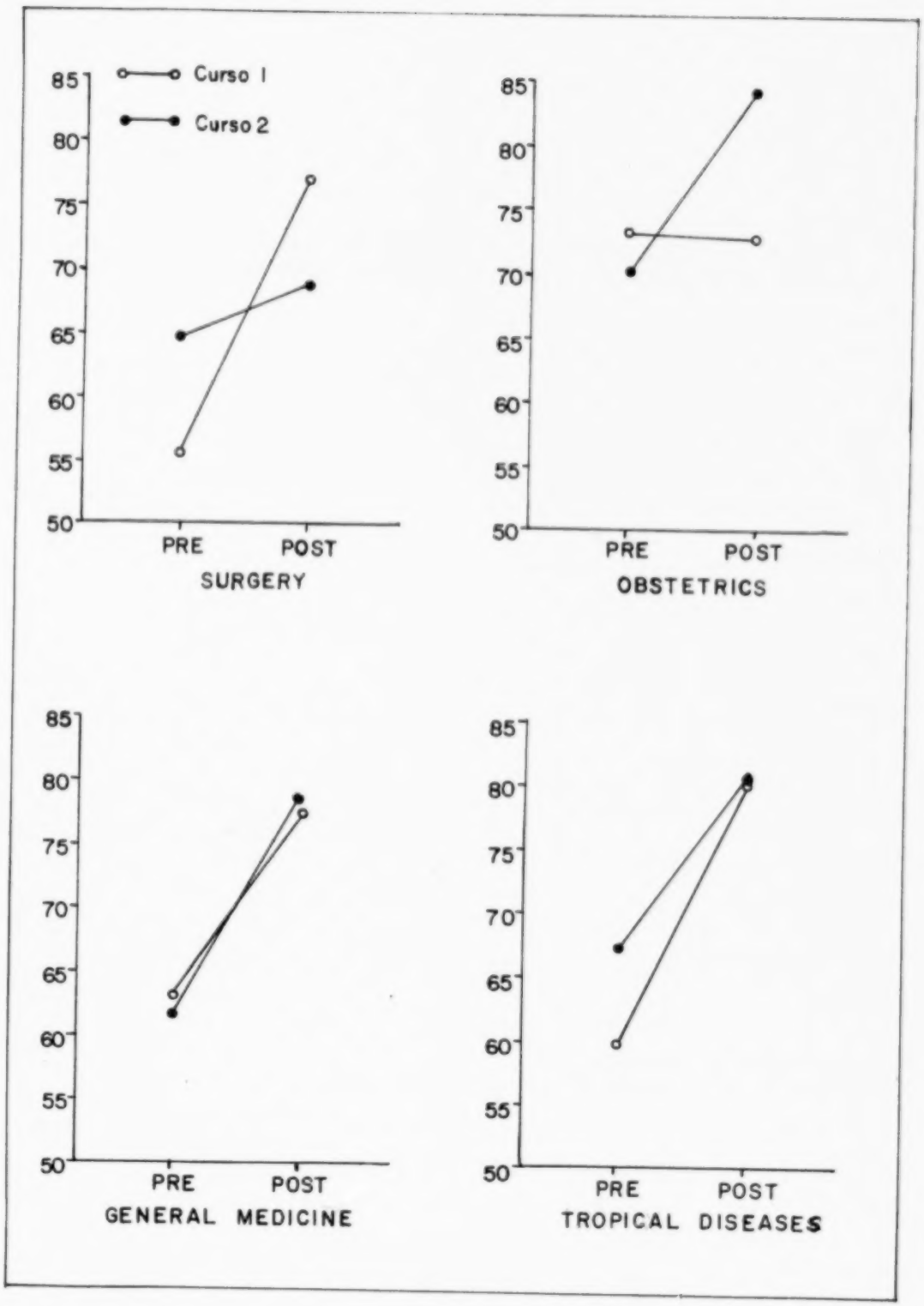

Figure 5: Gains on licensing examinations (clinical area) for Cursos 1 and 2.

TABLE 10

RESULTS OF MULTIVARIATE AND UNIVARIATE ANALYSES OF VARIANCE FOR CURSO DIFFERENCES IN GAIN ON THE 4 CLINICAL AREA LICENSING EXAMINATIONS

	Degrees of Freedom for Hypothesis	Degrees of Freedom for Error	F	
Multivariate Test[1]	4	58	14.409	p<.001
Univariate Tests				
Surgery	1	61	26.184	p<.001
Obstetrics	1	61	12.657	p<.001
General Medicine	1	61	0.010	--
Tropical Diseases	1	61	6.598	p<.05

[1]Test of significance using Wilks' lambda criterion.

observations derived from the figure, and these results are given in Table 10. It can be seen from Table 10 that not only is the overall pattern of gain significantly different in a statistical sense between the two Curso groups for the set of licensing examinations, but also the gain differences are statistically significant for three of the four tests when considering them individually. The direction of differential gain is obvious from Figure 5.

The results of our analyses for differential gain appear on the surface to be contradictory. In terms of the 12 UPR Medical Knowledge Tests, differential gain was strictly attributable to the Medical Science area subtests, while in terms of Licensing Examinations, there are clear-cut gain differences in terms of those examinations in the Clinical Area. It should be pointed out, however, that the contradiction may be a function of variables not directly related to the Curso but rather to the nature of the two sets of

instruments used and to certain restrictions placed on the data by using the most generally appropriate statistical tools. The first matter, basically that of non-standardization of the licensing instruments has been discussed elsewhere in this report. The second matter has also been mentioned but needs some clarification. Specifically, our two tests for differences in gain were not, strictly speaking, performed for the exact same people. The test for UPR test gain differences was for those Curso participants for which both pre- and post-Curso test scores were available. The test for licensing examination gain differences was for those Curso participants for which both pre- and post-Curso licensure examination scores were available; and the groups so defined are not identical (i.e.,some participants for whom UPR test results were available did not have available licensure examination results in the Clinical area prior to the Curso, others did not take the licensure examination on completion of the Curso for various reasons). Due to these possible distortions of the results, one should be cautious in drawing too many conclusions from the differential gains.

Overall Gains in Medical Knowledge for the Two Curso Groups

The question remains as to the significance of the overall gains for the two Cursos on the 12 Medical Knowledge Tests and for the clinical area licensure examination. Since it has been determined that the two Curso groups gain differentially in both areas, the appropriate tests of gains are within Curso groups. These analyses were performed, and the results are reported in Tables 11 through 14. As can be seen from Tables 11 and 12 the gains in both groups were highly significant ones on every individual

TABLE 11

MULTIVARIATE AND UNIVARIATE TESTS FOR SIGNIFICANT GAINS ON MEDICAL KNOWLEDGE TESTS FOR CURSO GROUP 1

	Degrees of Freedom for Hypothesis	Degrees of Freedom for Error	F	
Multivariate Test[1]	12	32	17.792	p<.001
Univariate Tests				
Anatomy	1	43	34.785	p<.001
Physiology	1	43	79.324	p<.001
Pharmacology	1	43	18.059	p<.001
Microbiology	1	43	40.488	p<.001
Biochemistry	1	43	11.454	p<.005
Pathology	1	43	43.435	p<.001
Surgery	1	43	13.610	p<.001
Obstetrics	1	43	32.762	p<.001
General Medicine	1	43	91.321	p<.001
Public Health	1	43	34.882	p<.001
Pediatrics	1	43	22.224	p<.001
Psychiatry	1	43	14.509	p<.001

[1]Test of significance using Wilks' lambda criterion.

TABLE 12

MULTIVARIATE AND UNIVARIATE TESTS FOR SIGNIFICANT GAINS ON MEDICAL KNOWLEDGE TESTS FOR CURSO GROUP 2

	Degrees of Freedom for Hypothesis	Degrees of Freedom for Error	F	
Multivariate Test[1]	12	21	19.597	p<.001
Univariate Tests				
Anatomy	1	32	5.611	p<.05
Physiology	1	32	14.648	p<.001
Pharmacology	1	32	5.166	p<.05
Microbiology	1	32	19.270	p<.001
Biochemistry	1	32	86.606	p<.001
Pathology	1	32	29.320	p<.001
Surgery	1	32	19.956	p<.001
Obstetrics	1	32	36.867	p<.001
General Medicine	1	32	57.156	p<.001
Public Health	1	32	62.482	p<.001
Pediatrics	1	32	31.508	p<.001
Psychiatry	1	32	17.085	p<.001

[1]Test of significance using Wilks' lambda criterion.

TABLE 13

MULTIVARIATE AND UNIVARIATE TESTS FOR SIGNIFICANT GAINS ON CLINICAL AREA LICENSURE EXAMINATIONS FOR CURSO GROUP 1

	Degrees of Freedom for Hypothesis	Degrees of Freedom for Error	F	
Multivariate Test[1]	4	28	55.645	p<.001
Univariate Tests				
Surgery	1	31	50.149	p<.001
Obstetrics	1	31	0.001	--
General Medicine	1	31	23.472	p<.001
Tropical Diseases	1	31	79.934	p<.001

[1]Test of significance using Wilks' lambda criterion.

TABLE 14

MULTIVARIATE AND UNIVARIATE TESTS FOR SIGNIFICANT GAINS ON CLINICAL AREA LICENSURE EXAMINATIONS FOR CURSO GROUP 2

	Degrees of Freedom for Hypothesis	Degrees of Freedom for Error	F	
Multivariate Test[1]	4	27	16.628	p<.001
Univariate Tests				
Surgery	1	31	1.267	--
Obstetrics	1	31	28.165	p<.001
General Medicine	1	31	45.822	p<.001
Tropical Diseases	1	31	27.518	p<.001

[1]Test of significance using Wilks' lambda criterion.

test of the UPR Medical Knowledge Battery (and for the Battery as a whole). This would tend to indicate an extremely beneficial impact of the Curso on both groups in terms of scores on the Medical Knowledge Tests (in both the basic medical science areas and in the clinical areas).

Tables 13 and 14 indicate that overall gain on the Clinical Area Licensing Examinations was significant, considering the entire set of examinations, for both Curso groups. For Curso 1 participants, the gain was significant on every individual test area except that of Obstetrics (in fact there was a very slight loss in that area). Curso 2 participants showed significant gains for all areas except that of Surgery. The overall picture is again indicative of a beneficial impact of the Curso in terms of Licensure examinations (at least for the Clinical Areas).

There are problems in interpretation, mentioned before, that somewhat cloud these indications; and, further, it can be argued that some gain is expected on the UPR Medical Knowledge Test Battery since the same tests were given at both administrations. In spite of such limitations on our findings, the preponderance of the findings strongly support the notion that the Curso de Perfeccionamiento (for both Curso groups) has served to increase substantially the medical knowledge of the participants.

Predictability of Licensure from Pre-Curso Data

Some comment has been made earlier regarding the general lack of single variable relationships of pre-Curso variables to the dichotomous variable of post-Curso licensure. Two basic approaches to this problem are standardly employed, using in both cases the entire set of "predictor" variables. One is the Multiple Regression approach, treating the dichotomous outcome as a two-valued variable (e.g., persons obtaining license can be assigned a score of 1, and those not obtaining license can be assigned a score of 0).

The topic of multiple regression is treated extensively in Draper and Smith (1966) and in most advanced statistics tests. The other approach is that of Discriminant Analysis (cf., Morrison, 1967), which finds some "best" dimension, representing a linear combination (a weighted sum) of the variables of interest, which maximally discriminates between two groups. We have chosen the latter approach for various technical reasons. Specifically we have used stepwise discriminant analysis, a technique which adds variables, one at a time, to the discriminant function on the basis of a predetermined decision rule. The specific program used was the BMD Stepwise Multiple Discriminant Analysis program (cf., Dixon, 1964). The decision rule adopted is a standard one, add that variable, of those remaining, which maximally discriminates between the two groups, given any discriminating power related to those variables (if any) already contributing to the discriminant function has been partialled out. Loosely speaking, the variable added is the one most discriminating any previously undiscriminated differences between the groups. The variables used in our discriminant analysis were the pre-Curso scores on the UPR Medical Knowledge Tests and the pre-Curso licensure examination scores in the Clinical Area (a total of 16 variables). The two groups were (1) those obtaining license on the first Board examination following the Curso, and (2) those not obtaining license. For purposes of this analysis, Curso 1 and Curso 2 participants were combined (both groups were reduced in size due to "missing data" on some variables, and the "repeaters" in Curso 2 were not used). The combination of groups seems justified due to the similarities in the two Curso groups of the relational patterns among the 16 variables of interest here. The resulting groups included a total of 67 Curso participants (40 who were licensed and 27 who were not).

As a result of the analysis it was determined that optimal discrimination between the Licensed and not Licensed group was obtained by using only 3 of the 16 variables. All three of these variables were from the set of UPR Medical Knowledge tests. They were the tests in the area of Anatomy, Surgery, and Psychiatry. The partial F values (representing the independent discriminability of the three variables after any discriminability of the remaining two has been partialled) are given in Table 15.

TABLE 15

PARTIAL F VALUES FOR THE THREE VARIABLES OF THE DISCRIMINANT FUNCTION

Variable	Weight	F	df	p
Anatomy	.123	2.7801	1,63	$p<.2$
Surgery	.160	3.6966	1,63	$p<.1$
Psychiatry	.116	3.0001	1,63	$p<.1$

The partial F values for those variables not included in the discriminant function (representing the residual discrimination of these variables after the discriminability of all three variables included in the discriminant function has been removed) are given in Table 16. From a casual observation of these two tables, it is clear that the variables of the discriminant function have greater discriminability than do those not included (as should be the case). The dimension (canonical variable) which best discriminates the Licensed and not Licensed groups is given, as previously stated, by a weighted sum of the scores on the three tests contributing to the discriminant function. The weights are given in Table 15 above. It should be noted that those weights are applied to the "standardized" scores (z scores, computed by subtracting the mean and then dividing by the standard deviation) and not the raw test scores.

TABLE 16

PARTIAL F VALUES FOR THE THIRTEEN VARIABLES
NOT INCLUDED IN THE DISCRIMINANT FUNCTION

Variable	F	df	p
UPR Medical Knowledge Tests			
Physiology	.2826	1,62	p>.5
Pharmacology	.5184	1,62	p>.5
Microbiology	.0839	1,62	p>.5
Biochemistry	.4543	1,62	p>.5
Pathology	.0526	1,62	p>.5
Obstetrics	1.2925	1,62	p>.2
General Medicine	1.5647	1,62	p>.2
Public Health	.2122	1,62	p>.5
Pediatrics	.0618	1,62	p>.5
Licensing Tests (Clinical Area)			
Surgery	.2077	1,62	p>.5
Obstetrics	.1324	1,62	p>.5
General Medicine	1.1541	1,62	p>.2
Tropical Diseases	1.2100	1,62	p>.2

TABLE 17

FREQUENCY DISTRIBUTIONS OF TWO GROUPS
ON CANONICAL VARIABLE

Value of Canonical Variable	Frequency for Group Obtaining License	Frequency for Group Not Obtaining License
-4.0 to -3.5		1
-3.5 to -3.0		
-3.0 to -2.5		2
-2.5 to -2.0		1
-2.0 to -1.5		3
-1.5 to -1.0	1	
-1.0 to -0.5	4	3
-0.5 to 0.0	4	5
0.0 to 0.5	10	3
0.5 to 1.0	9	3
1.0 to 1.5	7	1
1.5 to 2.0	5	

The frequency distribution of scores for the two groups in terms of this "best discriminating" dimension is given in Table 17. From the table, it can be seen that the group obtaining license has a higher average score than the group which did not obtain license. The group means are -.80 for the no License group and .54 for the group obtaining license. The discrimination is reflected in the multivariate F value (corresponding, in a loose way, to the univariate F for group differences on the canonical variable). The F value obtained was 9.343, with 3 and 63 degrees of freedom, which is significant at $p<.001$.

Of greater practical significance is the degree to which our post hoc classification scheme is successful in determining those who obtain license and those who do not. The correct and incorrect classifications, based on a cutoff point which is the value of the canonical variable half the distance between the two group means, are given in Table 18. From the table

TABLE 18

CORRECT AND INCORRECT CLASSIFICATIONS
OF CURSO PARTICIPANTS
BASED ON DISCRIMINANT ANALYSIS

Actual Group Membership	Classified as Belonging to Group	
	Obtaining License	Not Obtaining License
Obtained License	33	7
Did Not Obtain License	9	18

it can be seen that 51 of the 67 (over 76%) of the Curso participants were correctly classified on the basis of only three Pre-Curso Variables. This

statistic is not as impressive as it would appear at first glance, for it should be remembered that if we arbitrarily classified a person randomly into the licensed group or unlicensed group by the flip of a coin, then we would expect to correctly classify half of the persons so assigned (also, obviously, if we were to classify everyone into the licensed group we would have obtained exactly 40 correct classifications out of 67 (60%)). We can, however, examine our improvement in classification as compared to that which we would expect by random assignment. Our proportional improvement over random assignment is given by (51-33.5)/33.5 or .52. Thus we have a 52% improvement over chance assignment classification. The significance of this improvement over chance can be computed by the normal approximation to the binomial process we would obtain by random assignment (using $p=1/2$, $n=67$). The computed corrected z is 4.15 with level of significance less than .001. We can therefore state with considerable confidence that our discriminant analysis classification scheme is in fact an improvement over chance classification, and while the 76% correct classification rate is less impressive than it could be, it still provides an improved selection process.

It should be noted at this point that classification schemes based on such techniques as we have used often depend greatly on the specific group for which it is computed. That is to say, since the approach uses the most discriminating combination of variables based on available data, there is room for spurious relationships. Recent empirical studies[3] have shown dramatically the instability of "optimal" weights under use with a different sample. Some "cross-validation" of this predictor should be undertaken

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[3] See, for example, the work of Dawes of the Oregon Research Institute.

prior to using it as a screening tool. Nevertheless, considering the relatively small number of variables used in the discriminant function compared to the sample size, it is certainly indicated that the UPR Medical Knowledge Test Battery (specifically the three tests entering our discriminant function) could be used effectively in screening those applicants, for future Cursos, who have greatest potential in terms of passing the Licensing examination. To be sure, such screening is completely unwarranted as long as supply exceeds demand for the Curso and as long as funds are available for training all applicants. Errors, of one type or another, are always likely with any less-than-perfect selection rule. The major errors here are (1) selecting for training individuals who will not benefit (as reflected in their not obtaining license), and (2) excluding from training those who could benefit. It is not the significance of a predictive equation that is critical in such a case, but rather the careful weighting of the costs involved (and we mean by costs much more than those measurable in dollars) in making each of the two types of inevitable errors.

In this regard, it should also be pointed out that we considered in our prediction only the first administration of the Board examination following the Curso. It has been mentioned previously that some Curso participants who did not obtain license at this time did, in fact, obtain license on the following administration of the Board Exams. Further, we have not distinguished between Provisional, Special, or Regular License or between U. S. citizenship status. The careful reader will recognize that a type of "residual" analysis may clarify this point.

Individual Differences

Throughout our discussion we have concentrated on aggregates and averages in describing the effects of the Curso. It is quite instructive, however, to consider the individual Curso participant to obtain a "feel" for the thrust of the data. Obviously, examination of individual profiles for all participants on all variables presents a cumbersome task, the result of which is such a magnitude of data that one easily loses sight of the forest due to all the trees. For this reason we will concentrate on those data considered most reliable, the UPR Medical Knowledge Tests, and on a specific sub-group of Curso participants, the "repeaters" in Curso 2. This group is not chosen arbitrarily, but rather due to the fact that measures on the variables are available at three points in time (Pre-Curso 1, Post-Curso 1, and Post-Curso 2). The UPR Medical Knowledge Test Profiles for 6 of the "repeaters" are given in Appendix C (one "repeater" did not take the tests on completion of Curso 2). While it is surely unsound to generalize from such a small (and certainly unrepresentative) sample, the changes in test profiles from one administration to another reflect, to an extent, the broader data base. Scores for a given individual on a given test obviously do not show uniform or even consistent improvement. Where test scores actually decline from one administration of a test to the next, this probably reflects the unreliability of the test. Perhaps the most important observation is that there is a consistent overall raising of the test profile following both of the Cursos.

CONCLUSIONS

Considering the necessary limitations of the design, the very important question of relative impact of the Curso can not be answered in any definitive way. The results do indicate, however, that regarding Licensing Examinations, the Curso participants in general do as well as or better than comparable groups of foreign-trained physicians. It is also possible, with the data at hand, to speak directly to the question of absolute impact of the Curso on its participants and otherwise.

It was obvious from the early exploratory work that a substantial number of potential consumers existed on the Island. The relative ease with which the Curso attracted these consumers speaks to the attractiveness and credibility of the Curso as a viable instrument which could serve the medical needs of the Island and at the same time provide appropriate employment to foreign-trained physicians.

By all measures available, both Cursos appeared to be successful in improving the medical knowledge of the participants. This is overwhelmingly obvious from the analyses of Curso gains on both the UPR Medical Knowledge Test and on the licensing examination (subject to limitations previously specified).

In terms of producing sorely needed health manpower personnel in the form of licensed physicians, the Cursos were likewise successful. From a cost-efficiency point of view, the Cursos should fare quite well relative to other means of producing licensed physicians. The impact of this effect of the Curso goes considerably beyond the confines of the academic and clinical training facilities, extending to the potentially improved health care of hundreds of people on the Island.

There are now available effective screening instruments to be used for future Cursos, should the need occur. These instruments may in fact prove to be beneficial tools for evaluation in other areas of physician training.

Finally, the broader impacts of the Curso on medical planning for health care delivery systems, potential and untapped health care personnel pools, health care education, etc., are too numerous and diverse to document here. Suffice it to say that the planning, implementation and conduct of the Cursos have proved to be a catalyst for increased innovation within the medical education community. These intangible and diffuse benefits are most likely the greatest success of the Curso, in the final analysis.

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APPENDIX A

MEANS, STANDARD DEVIATIONS, AND CORRELATIONS FOR VARIABLE SETS

CURSO 1

TABLE A-1

MEANS AND STANDARD DEVIATIONS OF
PRE-CURSO VARIABLES (CURSO 1)

Variable	Mean	Standard Deviation	N
Verbal Aptitude	25.24	11.35	45
Mathematical Aptitude	9.76	3.91	45
English Reading	11.95	7.40	44
Anatomy	14.34	3.91	47
Physiology	13.34	4.82	47
Pharmacology	17.26	4.74	47
Microbiology	13.68	3.71	47
Biochemistry	16.35	4.60	46
Pathology	15.32	5.28	47
Surgery	11.21	3.54	47
Obstetrics	19.19	4.28	47
General Medicine	15.72	5.22	47
Public Health	15.45	3.78	47
Pediatrics	17.87	4.43	47
Psychiatry	15.47	3.92	47

TABLE A-2

MEANS AND STANDARD DEVIATIONS OF
PRE-CURSO LICENSING (CURSO 1)

Licensing Test	Mean	Standard Deviation	N
Anatomy	57.29	21.74	17
Physiology	63.76	10.97	17
Pharmacology	67.94	15.30	17
Pathology	62.88	14.45	17
Surgery	55.46	15.83	39
Obstetrics	72.63	11.74	38
General Medicine	63.42	12.70	38
Tropical Diseases	59.89	13.60	38

TABLE A-3

MEANS AND STANDARD DEVIATIONS FOR
POST-CURSO VARIABLES (CURSO 1)

Variable	Mean	Standard Deviation	N
Anatomy	17.51	3.91	45
Physiology	18.60	4.30	45
Pharmacology	19.71	3.49	45
Microbiology	17.47	3.85	45
Biochemistry	18.98	3.97	45
Pathology	20.38	5.21	45
Surgery	13.09	3.55	45
Obstetrics	22.58	4.14	45
General Medicine	21.18	4.86	45
Public Health	18.98	3.73	45
Pediatrics	21.67	4.98	45
Psychiatry	18.00	4.02	45

TABLE A-4

MEANS AND STANDARD DEVIATIONS OF
COURSE SCORES (CURSO 1)

Variable	Mean	Standard Deviation	N
Number of Quizzes Taken	9.28	1.98	43
Number of Quizzes Passed	7.37	2.02	43
Midterm 1	78.02	13.88	41
Midterm 2	63.65	9.88	43
Mean Standard Score All Quizzes	50.38	5.44	40
Pass-Fail	0.58	0.50	43
Rating	38.69	14.33	45

TABLE A-5

MEANS AND STANDARD DEVIATIONS OF
POST-CURSO LICENSING

Licensing Test	Mean	Standard Deviation	N
Anatomy	68.87	10.65	38
Physiology	72.21	12.17	39
Pharmacology	72.61	9.78	38
Pathology	77.03	10.13	39
Surgery	77.79	7.17	39
Obstetrics	73.21	7.90	38
General Medicine	77.82	7.92	38
Tropical Diseases	80.71	5.62	38
Practical	75.30	11.46	37

TABLE A-6

INTERCORRELATIONS OF PRE-CURSO VARIABLES (CURSO 1) $\underline{43} \leq N \leq \underline{47}$

	Verbal Aptitude	Mathematical Aptitude	English Reading Comprehension	Anatomy	Physiology	Pharmacology	Microbiology	Biochemistry	Pathology	Surgery	Obstetrics	Gen. Medicine	Public Health	Pediatrics
Mathematical Aptitude	516*													
English Reading Comprehension	666*	320*												
Anatomy	563*	193	431*											
Physiology	726*	269	542*	606*										
Pharmacology	327*	205	336*	555*	411*									
Microbiology	427*	249	346*	453*	524*	466*								
Biochemistry	477*	203	338*	487*	548*	652*	476*							
Pathology	217	032	066	316*	501*	209	506*	321*						
Surgery	374*	293	223	495*	380*	506*	338*	296*	317*					
Obstetrics	279	193	037	434*	424*	348*	503*	321*	500*	568*				
General Medicine	403*	191	302	514*	466*	447*	434*	498*	572*	405*	644*			
Public Health	577*	225	494*	571*	582*	506*	514*	444*	291*	349*	512*	461*		
Pediatrics	402*	176	419*	402*	485*	184*	374*	300*	454*	368*	392*	588*	484*	
Psychiatry	500*	359*	384*	546*	599*	383*	468*	339*	503*	295*	446*	394*	535*	348*

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE A-7

CORRELATIONS OF PRE-CURSO VARIABLES WITH PRE-LICENSING VARIABLES (CURSO 1) $\underline{16} \leq N \leq \underline{39}$

	Anatomy	Physiology	Pharmacology	Pathology	Surgery	Obstetrics	Gen. Medicine	Tropical Diseases
Verbal Aptitude	625*	794*	423	307	155	102	156	287
Mathematical Aptitude	481	175	274	377	220	024	111	149
English Reading Comprehension	374	310	265	052	163	073	077	055
Anatomy	524*	598*	496*	014	431*	251	126	303
Physiology	645*	486*	658*	129	336*	342*	059	232
Pharmacology	571*	169	259	127	417*	124	041	250
Microbiology	287	482	204	338	184	184	150	337*
Biochemistry	573*	701*	570*	213	464*	258	018	425*
Pathology	032	386	188	011	268	167	061	158
Surgery	597*	070	616*	083	284	033	097	336*
Obstetrics	248	229	293	189	050	078	097	259
General Medicine	024	364	132	312	215	072	019	355*
Public Health	359	438	420	294	072	252	080	204
Pediatrics	170	308	470	316	168	271	010	088
Psychiatry	598*	676*	330	184	066	198	008	160

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE A-8

CORRELATIONS OF PRE-CURSO VARIABLES WITH COURSE SCORE VARIABLES (CURSO 1) $37 \leq N \leq 43$

	# Quizzes Taken	# Quizzes Passed	Midterm 1	Midterm 2	Mean Standard Quiz Score	Rating
Verbal Aptitude	001	219	261	374*	574*	166
Mathematical Aptitude	006	078	088	101	193	101
English Reading Comprehension	018	120	235	270	615*	055
Anatomy	203	108	285	515*	459*	007
Physiology	025	222	086	364*	562*	169
Pharmacology	058	202	130	398*	346*	224
Microbiology	148	155	124	294	490*	027
Biochemistry	086	162	082	384*	284	011
Pathology	005	263	144	495*	304	018
Surgery	102	110	210	581*	272	105
Obstetrics	055	207	053	380*	285	064
General Medicine	050	256	044	456*	447*	015
Public Health	068	151	178	278	600*	170
Pediatrics	153	055	148	381*	338*	062
Psychiatry	001	074	024	190	386*	024

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE A-9

CORRELATIONS OF PRE-CURSO VARIABLES WITH POST-TESTING VARIABLES (CURSO 1) $\underline{42} \leq N \leq \underline{45}$

	Anatomy	Physiology	Pharmacology	Microbiology	Biochemistry	Pathology	Surgery	Obstetrics	Gen. Medicine	Public Health	Pediatrics	Psychiatry
Verbal Aptitude	465*	558*	398*	334*	500*	370*	331*	272	377*	490*	348*	441*
Mathematical Aptitude	164	169	210	192	122	236	041	142	187	124	120	326*
English Reading Comprehension	479*	417*	458*	295	395*	324*	092	068	274	484*	202	370*
Anatomy	596*	711*	509*	426*	413*	441*	334*	401*	537*	367*	417*	429*
Physiology	482*	636*	463*	333*	558*	461*	276	288	347*	332*	260	301
Pharmacology	482*	666*	545*	558*	456*	487*	450*	325*	426*	236	445*	226
Microbiology	474*	508*	319*	457*	377*	508*	218	309*	394*	304*	361*	266
Biochemistry	401*	556*	446*	478*	376*	579*	455*	217	257	158	228	136
Pathology	247*	334*	004	199	373*	518*	261	469*	409*	049	245	157
Surgery	349*	630*	362*	190	202	419*	526*	521*	547*	208	454*	304*
Obstetrics	175	474*	215	221	225	402*	563*	575*	620*	122	412*	328*
General Medicine	127	598*	334*	274	416*	483*	561*	351*	677*	254	392*	234
Public Health	436*	546*	361*	497*	460*	360*	228	319*	522*	477*	491*	419*
Pediatrics	154	354*	182	159	371*	305*	309*	422*	414*	263	373*	168
Psychiatry	279	444*	185	208	461*	330*	202	351*	360*	143	245	412*

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE A-10

CORRELATIONS OF PRE-CURSO VARIABLES WITH POST-LICENSING VARIABLES (CURSO 1) $\underline{36} \leq N \leq \underline{45}$

	Pass-Fail	Anatomy	Physiology	Pharmacology	Pathology	Surgery	Obstetrics	Gen. Medicine	Tropical Diseases	Practical
Verbal Aptitude	276	393*	433*	417*	371*	278	012	388*	015	213
Mathematical Aptitude	005	178	174	259	057	055	120	290	121	097
English Reading Comprehension	132	284	402*	401*	213	109	041	149	022	010
Anatomy	537*	601*	547*	468*	586*	353*	178	423*	034	376*
Physiology	342*	508*	423*	226	465*	182	043	335*	040	240
Pharmacology	320*	429*	472*	340*	476*	329*	076	399*	437*	220
Microbiology	234	324	487*	280	391*	212	004	410*	378*	276
Biochemistry	376*	338*	492*	241	665*	309	024	100	385*	178
Pathology	334*	144	279	230	300	154	034	275	151	356*
Surgery	369*	590*	359*	439*	394*	474*	008	446*	120	290
Obstetrics	370*	566*	455*	357*	475*	490*	222	531*	290	224
General Medicine	425*	402*	564*	458*	432*	371*	074	465*	096	348*
Public Health	375*	434*	542*	528*	639*	221	185	445*	237	288
Pediatrics	206*	214	344*	319	299	294	016	329*	057	001
Psychiatry	505*	265	425*	243	371*	161	000	538*	024	358*

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE A-11

INTERCORRELATIONS OF PRE-LICENSING VARIABLES (CURSO 1) $15 \leq N \leq 39$

	Anatomy	Physiology	Pharmacology	Pathology	Surgery	Obstetrics	General Medicine
Physiology	477*						
Pharmacology	722*	382					
Pathology	377	372	218				
Surgery	306	541*	554*	137			
Obstetrics	432	526*	720*	468	162		
General Medicine	157	137	234	080	098	247	
Tropical Diseases	611*	481	743*	313	098	247	200

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE A-12

CORRELATIONS OF PRE-LICENSING VARIABLES WITH COURSE SCORE VARIABLES (CURSO 1) $\underline{13} \leq N \leq \underline{36}$

	# Quizzes Taken	# Quizzes Passed	Midterm 1	Midterm 2	Mean Standard Quiz Score	Rating
Anatomy	144	051	204	047	388	027
Physiology	033	035	226	122	525	167
Pharmacology	157	121	178	504	210	211
Pathology	266	238	340	327	291	311
Surgery	048	232	173	336	009	016
Obstetrics	299	240	021	055	003	181
General Medicine	125	062	042	133	108	129
Tropical Diseases	193	033	092	176	117	130

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE A-13

CORRELATIONS OF PRE-LICENSING VARIABLES WITH POST-TESTING VARIABLES (CURSO 1) $16 \leq N \leq 45$

	Anatomy	Physiology	Pharma-cology	Pathology	Surgery	Obstetrics	Gen. Med.	Tropical Diseases
Anatomy	357	452	416	275	380*	214	082	225
Physiology	641*	420	442	057	301	024	097	258
Pharmacology	520*	199	548*	297	239	022	006	098
Microbiology	027	111	031	236	249	106	088	210
Biochemistry	352	642	345	056	222	006	046	094
Pathology	362	474	253	225	322	090	174	074
Surgery	220	455	159	233	307	262	250	287
Obstetrics	177	321	144	260	310	066	152	046
General Medicine	136	151	084	115	167	335	060	134
Public Health	164	324	062	118	106	018	105	073
Pediatrics	139	406	187	044	057	207	094	153
Psychiatry	440	263	361	065	138	047	012	103

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE A-14

CORRELATIONS OF PRE-LICENSING VARIABLES WITH POST-TESTING VARIABLES (CURSO 1) $\underline{13} \leq N \leq \underline{37}$

	Anatomy	Physiology	Pharmacology	Pathology	Surgery	Obstetrics	Gen. Medicine	Trop. Diseases
Pass-Fail	203	621*	115	244	196	015	124	226
Anatomy	641*	430	642*	002	206	18[illegible]	006	423*
Physiology	560*	732*	680*	339	224	188	205	274
Pharmacology	121	646*	348	239	050	082	002	014
Pathology	499	650*	673*	377	231	399*	142	300
Surgery	197	366	042	012	110	466*	228	326
Obstetrics	195	257	330	304	186	250	323	014
General Medicine	429	539	246	346	082	005	242	527*
Tropical Diseases	082	176	027	414	004	156	227	254
Practical	068	428	163	037	226	304	238	198

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE A-15

INTERCORRELATIONS OF COURSE SCORE VARIABLES (CURSO 1) $\underline{40} \leq N \leq \underline{43}$

	# Quizzes Taken	# Quizzes Passed	Midterm 1	Midterm 2	Mean Standard Quiz Score
# Quizzes Passed	692*				
Midterm 1	209	148			
Midterm 2	125	357*	520*		
Mean Standard Quiz Score	111	485*	352*	476*	
Rating	076	227	043	025	142

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE A-16

CORRELATIONS OF COURSE SCORE VARIABLES WITH POST-TESTING VARIABLES (CURSO 1) $\underline{40} \leq N \leq \underline{44}$

	# Quizzes Taken	# Quizzes Passed	Midterm 1	Midterm 2	Mean Standard Quiz Score	Rating
Anatomy	066	260	548*	431*	456*	021
Physiology	146	189	275	546*	610*	115
Pharmacology	166	150	261	385*	533*	054
Microbiology	186	270	331*	410	494*	200
Biochemistry	059	300	271	401*	582*	001
Pathology	005	469*	246	631*	629*	024
Surgery	012	282	155	587*	358*	096
Obstetrics	063	191	156	529*	234	141
General Medicine	135	540*	325*	608*	648*	074
Public Health	175	275	364*	387*	707*	212
Pediatrics	024	281	307	497*	519*	014
Psychiatry	058	171	343*	238	497*	118

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE A-17

CORRELATIONS OF COURSE SCORE VARIABLES WITH POST-LICENSING VARIABLES (CURSO 1) $33 \leq N \leq 40$

	# Quizzes Taken	# Quizzes Passed	Midterm 1	Midterm 2	Mean Standard Quiz Score	Rating
Pass-Fail	055	054	111	166	086	075
Anatomy	022	159	148	425*	212	086
Physiology	151	285	289	455*	683*	222
Pharmacology	110	161	584*	516*	501*	090
Pathology	076	159	203	412*	422*	248
Surgery	078	120	059	322	050	006
Obstetrics	055	146	208	234	130	093
General Medicine	024	074	073	215	209	060
Tropical Diseases	218	010	033	217	062	121
Practical	342	356*	008	002	256	131

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE A-18

INTERCORRELATIONS OF POST-TESTING VARIABLES (CURSO 1) $45 \leq N \leq 45$

	Anatomy	Physiology	Pharmacology	Microbiology	Biochemistry	Pathology	Surgery	Obstetrics	Gen. Medicine	Public Health	Pediatrics
Physiology	476*										
Pharmacology	507*	540*									
Microbiology	528*	467*	439*								
Biochemistry	386*	603*	339*	542*							
Pathology	548*	582*	404*	518*	461*						
Surgery	251	538*	364*	295	352*	510*					
Obstetrics	299	369*	199	158	295	366*	547*				
General Medicine	414*	643*	348*	450*	430*	658*	598*	467*			
Public Health	430*	413*	449*	508*	433*	398*	313*	244	424*		
Pediatrics	417*	551*	497*	512*	518*	490*	530*	489*	616*	632*	
Psychiatry	481*	367*	466*	399*	219	300	284	400*	427*	419*	419*

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE A-19

CORRELATIONS OF POST-TESTING VARIABLES WITH POST-LICENSING VARIABLES (CURSO 1) $\underline{37} \leq N \leq \underline{42}$

	Pass-Fail	Anatomy	Physiology	Pharmacology	Pathology	Surgery	Obstetrics	Gen. Medicine	Tropical Diseases	Practical
Anatomy	350*	520*	597*	636*	555*	295	160	298	324	174
Physiology	454*	586*	659*	647*	710*	478*	159	465*	163	233
Pharmacology	068	626*	422*	330*	410*	180	119	136	216	020
Microbiology	277	382*	680*	497*	611*	405*	377*	336*	514*	074
Biochemistry	334*	251	632*	487*	542*	342*	077	302	154	176
Pathology	379*	349*	711*	484*	591*	386*	324	280	429*	166
Surgery	433*	334*	400*	363*	335*	615*	168	477*	192	129
Obstetrics	389*	232	185	266	119	510*	144	310	106	233
General Medicine	455*	457*	700*	639*	515*	476*	402*	575*	187	447*
Public Health	268	321	523*	449*	311	346*	309	374*	133	109
Pediatrics	448*	511*	572*	546*	512*	654*	201	607*	262	299
Psychiatry	307*	316	503*	496*	299	250	126	350*	018	167

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE A-20

INTERCORRELATIONS OF POST-LICENSING VARIABLES (CURSO 1) $\underline{33} \leq N \leq \underline{39}$

	Pass-Fail	Anatomy	Physiology	Pharmacology	Pathology	Surgery	Obstetrics	Gen. Medicine	Trop. Diseases
Anatomy	316								
Physiology	475*	468*							
Pharmacology	358*	392*	610*						
Pathology	493*	661*	725*	588*					
Surgery	683*	505*	401*	401*	445*				
Obstetrics	367*	050	278	285	148	473*			
General Medicine	573	473*	398*	348*	304	523*	185		
Tropical Diseases	123	418	410*	224	524*	255	110	310	
Practical	538*	127	215	017	248	213	125	292	136

*Correlation is significant at .05 level

NOTE: Decimal is omitted

APPENDIX B

MEANS, STANDARD DEVIATIONS, AND CORRELATIONS FOR VARIABLE SETS

CURSO 2

TABLE B-1

MEANS AND STANDARD DEVIATIONS FOR
PRE-CURSO VARIABLES (CURSO 2)

Variable	Mean	Standard Deviation	N
Verbal Aptitude	24.03	10.21	34
Mathematical Aptitude	8.74	3.44	34
English Reading	11.27	5.77	33
Anatomy	14.56	4.02	34
Physiology	14.82	4.52	34
Pharmacology	17.27	4.14	34
Microbiology	15.32	3.39	34
Biochemistry	15.88	4.35	34
Pathology	15.29	4.23	34
Surgery	11.00	2.75	34
Obstetrics	19.65	4.21	34
General Medicine	17.24	3.49	34
Public Health	15.88	3.26	34
Pediatrics	17.53	4.72	34
Psychiatry	16.00	4.13	34

TABLE B-2

MEANS AND STANDARD DEVIATIONS FOR
PRE-CURSO LICENSING (CURSO 2)

License Test	Mean	Standard Deviation	N
Anatomy	63.40	16.37	15
Physiology	64.00	12.39	15
Pharmacology	66.00	7.46	15
Pathology	66.40	12.43	15
Surgery	65.24	11.90	34
Obstetrics	71.24	11.46	34
General Medicine	63.03	15.63	34
Tropical Diseases	67.94	12.23	34

TABLE B-3

MEANS AND STANDARD DEVIATIONS FOR
POST-CURSO VARIABLES (CURSO 2)

Variable	Mean	Standard Deviation	N
Anatomy	15.88	3.94	33
Physiology	17.91	4.57	33
Pharmacology	18.82	4.88	33
Microbiology	17.67	3.69	33
Biochemistry	23.58	4.72	33
Pathology	19.64	5.41	33
Surgery	13.42	3.31	33
Obstetrics	23.95	3.83	33
General Medicine	22.09	5.03	33
Public Health	20.21	2.80	33
Pediatrics	22.03	5.14	33
Psychiatry	18.79	3.55	33

TABLE B-4

MEANS AND STANDARD DEVIATIONS FOR
COURSE SCORES (CURSO 2)

Score	Mean	Standard Deviation	N
Midterm 1	100.17	13.82	30
Midterm 2	97.84	19.22	31

TABLE B-5

MEANS AND STANDARD DEVIATIONS FOR
POST-CURSO LICENSING (CURSO 2)

Licensing Test	Mean	Standard Deviation	N
Pass-Fail	0.68	0.48	31
Anatomy	56.41	17.03	29
Physiology	75.79	9.70	29
Pharmacology	71.55	9.51	29
Pathology	75.17	8.34	29
Surgery	67.84	10.21	31
Obstetrics	83.90	5.56	31
General Medicine	77.77	9.26	31
Tropical Diseases	80.16	7.24	31
Practical	77.16	8.03	31

TABLE B-6

INTERCORRELATIONS OF PRE-CURSO VARIABLES (CURSO 2) $\underline{33} \leq N \leq \underline{34}$

	Verbal Aptitude	Mathematical Aptitude	English Reading	Anatomy	Physiology	Pharmacology	Microbiology	Biochemistry	Pathology	Surgery	Obstetrics	General Medicine	Public Health	Pediatrics
Mathematical Aptitude	612*													
English Reading	491*	384*												
Anatomy	408*	497*	474*											
Physiology	467*	470*	429*	580*										
Pharmacology	359*	536*	227	463*	596*									
Microbiology	178	262	126	513*	213	518*								
Biochemistry	260	271	275	569*	430*	360*	506*							
Pathology	278	303	313	611*	516*	424*	502*	394*						
Surgery	359*	467*	245	416*	324	314	325	215	445*					
Obstetrics	302	357*	034	356*	258	360*	578*	187	282	406*				
General Medicine	224	502*	150	588*	569*	450*	385*	513*	483*	344	223			
Public Health	247	403*	258	408*	552*	400*	061	237	403*	575*	278	328		
Pediatrics	140	533*	186	528*	498*	400*	392*	285	269	520*	551*	643*	440*	
Psychiatry	285	266	089	441*	608*	474*	270	170	381*	394*	349*	462*	399*	441*

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE B-7

CORRELATIONS OF PRE-CURSO VARIABLES WITH PRE-CURSO LICENSING VARIABLES (CURSO 2) $\underline{14} \leq N \leq \underline{34}$

	Anatomy	Physiology	Pharmacology	Pathology	Surgery	Obstetrics	General Medicine	Tropical Diseases
Verbal Aptitude	237	006	433	247	216	032	040	147
Mathematical Aptitude	165	066	066	173	474*	155	186	225
English Reading	494	308	148	135	273	156	202	065
Anatomy	087	564*	012	131	518*	119	416*	004
Physiology	223	380	104	592*	497*	048	345	108
Pharmacology	189	418	194	475	278	170	201	143
Microbiology	633*	151	258	182	301	040	190	276
Biochemistry	373	291	031	013	227	097	378*	070
Pathology	129	591*	352	507*	331	324	386*	036
Surgery	041	256	129	313	510*	125	190	165
Obstetrics	028	286	258	153	401*	090	004	154
General Medicine	627*	192	177	609*	616*	178	443*	237
Public Health	447	732*	262	401	480*	036	242	154
Pediatrics	120	097	228	290	808*	152	344	152
Psychiatry	440	068	279	360	351*	021	274	008

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE B-8

CORRELATIONS OF PRE-CURSO VARIABLES WITH COURSE SCORES (CURSO 2) $\underline{29} \leq N \leq \underline{31}$

	Midterm 1	Midterm 2
Verbal Aptitude	057	127
Mathematical Aptitude	047	118
English Reading	439*	221
Anatomy	451*	367*
Physiology	186	020
Pharmacology	105	099
Microbiology	058	205
Biochemistry	108	032
Pathology	166	195
Surgery	117	232
Obstetrics	192	191
General Medicine	201	057
Public Health	137	086
Pediatrics	135	275
Psychiatry	108	084

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE B-9

CORRELATIONS OF PRE-CURSO VARIABLES WITH POST-CURSO VARIABLES (CURSO 2) $32 \leq N \leq 33$

	Anatomy	Physiology	Pharmacology	Microbiology	Biochemistry	Pathology	Surgery	Obstetrics	General Medicine	Public Health	Pediatrics	Psychiatry
Verbal Aptitude	313	414*	253	167	238	254	492*	209	301	083	160	372*
Mathematical Aptitude	425*	519*	406	378*	261	189	429*	176	487*	266	414*	527*
English Reading	242	291	155	117	550*	302	227	020	224	040	250	247
Anatomy	606*	501*	320	553*	563*	396*	392*	209	671*	128	629*	476*
Physiology	308	487*	267	316	336	359*	550*	152	615*	331	500*	570*
Pharmacology	404*	390*	640*	326	292	601*	389*	098	538*	305	403*	579*
Microbiology	445*	252	536*	603*	346	574*	212	226	494*	142	378*	203
Biochemistry	262	292	312	462*	409*	523	118	155	330	273	288	222
Pathology	499*	419*	472*	468*	391*	526*	363*	292	440*	131	459*	350*
Surgery	456*	502*	340	424*	353*	324	512*	545*	453*	276	320	186
Obstetrics	446*	396*	206	549*	068	320	366*	521*	405*	298	440*	320
General Medicine	406*	288	567*	453*	202	320	422*	264	686*	344	512*	393*
Public Health	277	485*	319	295	340	215	393*	258	412*	490*	305	301
Pediatrics	409*	423*	418*	592*	279	310	351*	411*	739*	428*	596*	371*
Psychiatry	358	341	238	144	114	308	295	210	587*	141	279	557*

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE B-10

CORRELATIONS OF PRE-CURSO VARIABLES WITH POST-CURSO LICENSING VARIABLES (CURSO 2) $28 \leq N \leq 31$

	Pass-Fail	Anatomy	Physiology	Pharmacology	Pathology	Surgery	Obstetrics	General Medicine	Tropical Diseases	Practical
Verbal Aptitude	145	134	457*	104	084	380*	066	201	064	055
Mathematical	218	426*	371*	394*	193	438*	312	449*	321	369*
English Reading	042	416*	361*	474*	363*	391*	244	450*	103	025
Anatomy	391*	560*	664*	652*	530*	601*	593*	628*	311	214
Physiology	159	378*	396*	294	492*	408*	389*	452*	022	148
Pharmacology	080	169	379*	343	464*	266	222	364*	134	366*
Microbiology	251	211	383*	367*	491*	379*	377*	379*	238	154
Biochemistry	174	312	210	405*	458*	143	338	477*	012	309
Pathology	330	461*	290	373*	523*	451*	495*	426*	321	100
Surgery	552*	367*	238	362*	220	410*	539*	583*	282	061
Obstetrics	342	022	354	101	223	378*	508*	280	238	202
General Medicine	337	478*	328	540*	520*	441*	310	638*	352*	325
Public Health	225	166	381*	179	141	221	442*	397*	133	118
Pediatrics	393*	277	423*	448*	242	463*	560*	742*	357*	426*
Psychiatry	205	211	178	010	136	345	244	300	014	057

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE B-11

INTERCORRELATIONS OF PRE-CURSO LICENSING VARIABLES (CURSO 2) $\underline{15} \leq N \leq \underline{34}$

	Anatomy	Physiology	Pharmacology	Pathology	Surgery	Obstetrics	General Medicine
Physiology	210						
Pharmacology	196	418					
Pathology	182	394	529*				
Surgery	209	001	083	434			
Obstetrics	163	225	205	224	096		
General Medicine	290	130	185	174	418*	169	
Tropical Diseases	242	050	291	170	138	332	298

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE B-12

CORRELATIONS OF PRE-CURSO LICENSING VARIABLES WITH COURSE SCORE VARIABLES

(CURSO 2) $\underline{13} \leq N \leq \underline{31}$

	Midterm 1	Midterm 2
Anatomy	266	344
Physiology	635*	322
Pharmacology	370	284
Pathology	156	004
Surgery	288	294
Obstetrics	382*	315
General Medicine	084	032
Tropical Diseases	253	305

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE B-13

CORRELATIONS OF PRE-CURSO LICENSING VARIABLES WITH POST-CURSO VARIABLES (CURSO 2) $14 \leq N \leq 33$

	Anatomy	Physiology	Pharmacology	Pathology	Surgery	Obstetrics	General Medicine	Tropical Diseases
Anatomy	410	304	034	368	196	112	225	027
Physiology	009	298	364	234	452*	046	146	024
Pharmacology	200	590*	280	425	343	225	113	048
Microbiology	271	089	290	118	451*	047	216	129
Biochemistry	188	525*	499*	212	295	273	112	219
Pathology	029	047	121	122	378*	020	227	275
Surgery	066	117	102	358	422*	034	038	038
Obstetrics	085	088	033	113	332	146	150	047
General Medicine	294	500*	375	466	664*	079	336	026
Public Health	082	142	277	239	383*	080	254	104
Pediatrics	020	256	491	242	624*	183	288	032
Psychiatry	059	081	116	117	217	320	143	056

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE B-14

CORRELATIONS OF PRE-CURSO LICENSING VARIABLES WITH POST-CURSO LICENSING VARIABLES (CURSO 2) $13 \leq N \leq 31$

	Anatomy	Physiology	Pharmacology	Pathology	Surgery	Obstetrics	General Medicine	Tropical Diseases
Pass-Fail	389	275	469	357	342	008	196	150
Anatomy	376	262	285	716*	243	078	105	335
Physiology	251	374	134	253	479*	181	049	087
Pharmacology	026	476	596*	308	490*	090	278	094
Pathology	019	244	255	558*	344	131	047	109
Surgery	079	499	354	655*	437*	040	176	063
Obstetrics	172	576*	575*	285	555*	012	312	082
General Medicine	267	270	023	461	658*	077	588*	395*
Tropical Diseases	344	190	150	135	320	250	154	258
Practical	159	048	150	113	188	179	235	091

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE B-15

CORRELATIONS OF POST-CURSO VARIABLES WITH COURSE SCORE VARIABLES

(CURSO 2) $\underline{30} \leq N \leq \underline{31}$

	Midterm 1	Midterm 2
Anatomy	052	052
Physiology	308	336
Pharmacology	171	305
Microbiology	027	119
Biochemistry	649*	636*
Pathology	209	364*
Surgery	203	123
Obstetrics	068	355*
General Medicine	435*	454*
Public Health	148	084
Pediatrics	454*	438*
Psychiatry	132	092

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE B-16

INTERCORRELATIONS OF POST-CURSO VARIABLES (CURSO 2) $\underline{33} \leq N \leq \underline{33}$

	Anatomy	Physiology	Pharmacology	Microbiology	Biochemistry	Pathology	Surgery	Obstetrics	General Medicine	Public Health	Pediatrics
Physiology	346										
Pharmacology	174	323									
Microbiology	443*	258*	371*								
Biochemistry	217	575*	412*	293							
Pathology	180	530*	598*	310	448*						
Surgery	542*	485*	247	386*	232	278					
Obstetrics	281	293	315	381	232	225	438*				
General Medicine	411*	510*	585*	410*	483*	474*	576*	458*			
Public Health	144	058	297	385*	142	011	297	464*	313		
Pediatrics	371*	722*	355*	386*	509*	446*	472*	389*	663*	182	
Psychiatry	443*	473*	338	257	292	210	351*	222	454*	234	547*

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE B-17

CORRELATIONS OF PRE-CURSO VARIABLES WITH POST-CURSO LICENSING VARIABLES (CURSO 2) $\underline{29} \leq N \leq \underline{31}$

	Pass-Fail	Anatomy	Physiology	Pharmacology	Pathology	Surgery	Obstetrics	General Medicine	Tropical Diseases	Practical
Anatomy	308	480*	364*	430*	204	398*	418*	387*	317	459*
Physiology	419*	541*	541*	550*	413*	572*	489*	469*	334	303
Pharmacology	282	120	438*	442*	401*	394*	166	449*	454*	310
Microbiology	383*	380*	483*	408*	453*	361*	530*	602*	498*	280
Biochemistry	353*	337	529*	658*	400*	508*	503*	475*	264	194
Pathology	180	242	410*	379*	604*	352*	188	444	245	061
Surgery	468*	423*	472*	454*	370*	493*	480*	437*	304	294
Obstetrics	618*	042	272	329	034	359*	578*	477*	406*	388*
General Medicine	558*	317	662*	605*	369*	658*	598*	718*	485*	350*
Public Health	168	225	210	124	011	036	260	197	132	366*
Pediatrics	495*	464*	629*	831*	500*	576*	716*	628*	487*	501*
Psychiatry	117	369*	459*	433*	226	296	251	273	334	456*

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE B-18

INTERCORRELATION OF COURSE SCORE VARIABLES (CURSO 2) N = 28

	Midterm 1
Midterm 2	723*

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE B-19

CORRELATIONS OF COURSE SCORE VARIABLES WITH POST-CURSO LICENSING VARIABLES

(CURSO 2) $\underline{27} \leq N \leq \underline{30}$

	Midterm 1	Midterm 2
Pass-Fail	390*	489*
Anatomy	198	142
Physiology	468*	308
Pharmacology	638*	374*
Pathology	339	029
Surgery	491*	413*
Obstetrics	436*	440*
General Medicine	404*	323
Tropical Diseases	280	300
Practical	088	116

*Correlation is significant at .05 level

NOTE: Decimal is omitted

TABLE B-20

INTERCORRELATIONS OF POST-CURSO LICENSING VARIABLES (CURSO 2) $29 \leq N \leq 31$

	Pass-Fail	Anatomy	Physiology	Pharmacology	Pathology	Surgery	Obstetrics	General Medicine	Tropical Diseases
Anatomy	375*								
Physiology	213	220							
Pharmacology	433*	557*	578*						
Pathology	173	581*	381*	571*					
Surgery	635*	572*	520*	601*	561*				
Obstetrics	706*	338	370*	604*	324	605*			
General Medicine	657*	593*	407*	720*	431*	612*	672*		
Tropical Diseases	548*	325	455*	479*	132	352*	392*	512*	
Practical	171	083	222	529*	060	133	344	360*	329

*Correlation is significant at .05 level

NOTE: Decimal is omitted

APPENDIX C

UPR MEDICAL KNOWLEDGE
TEST SCORE PROFILES FOR SIX
FOREIGN TRAINED PHYSICIANS
WHO PARTICIPATED IN BOTH CURSOS

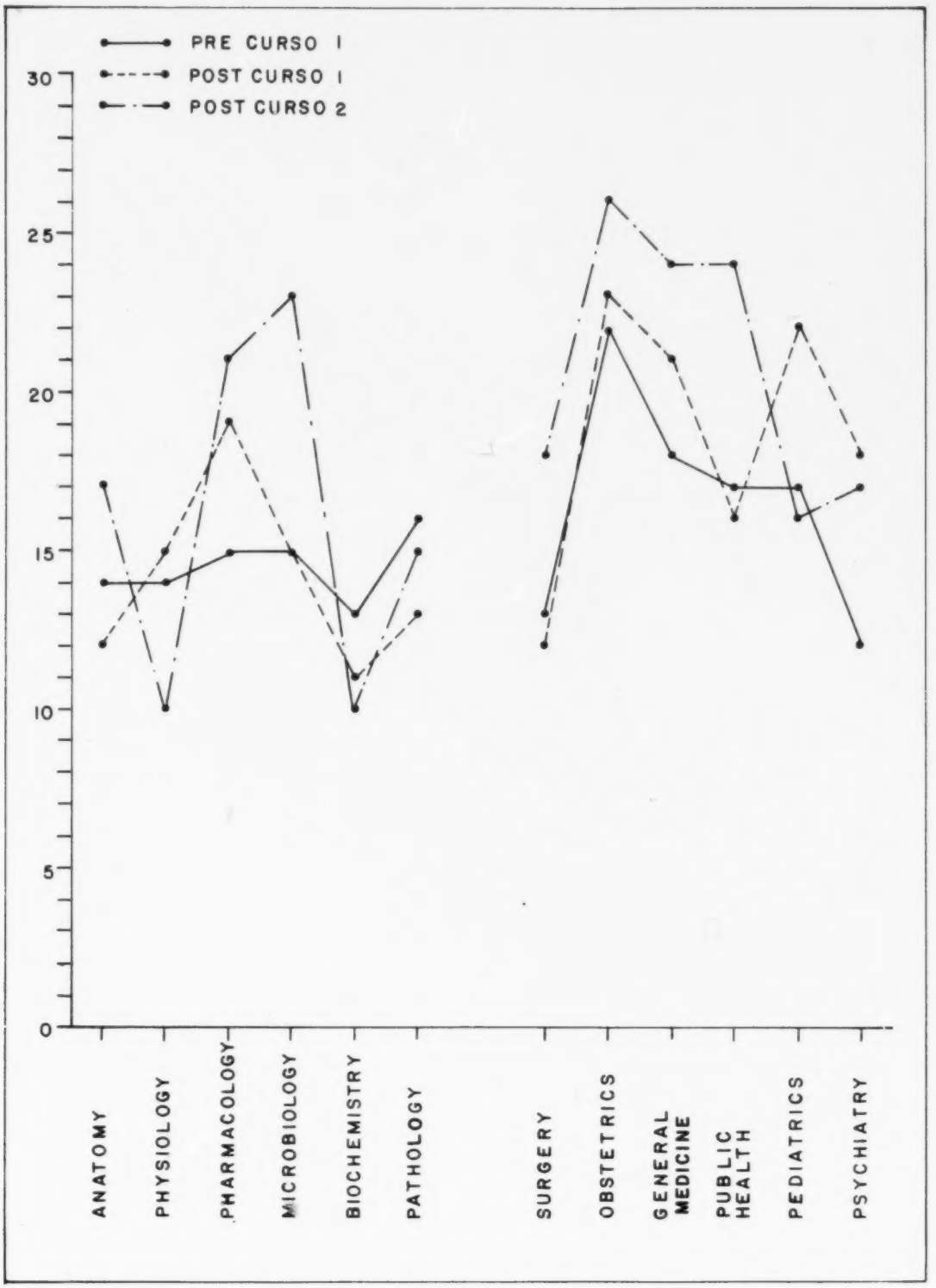

Figure C-1: Test Profiles for Physician No. 393

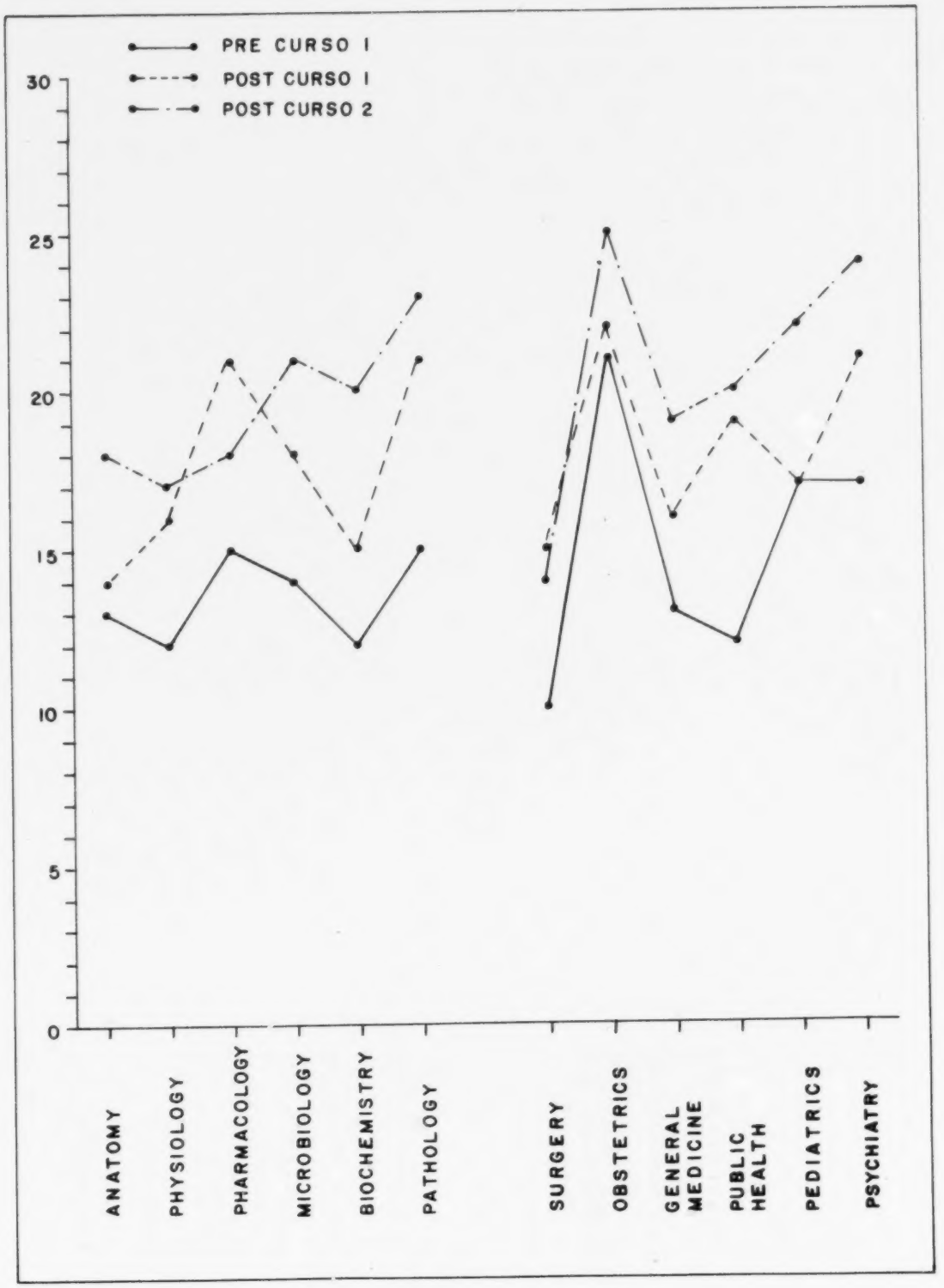

Figure C-2: Test Profiles for Physician No. 296

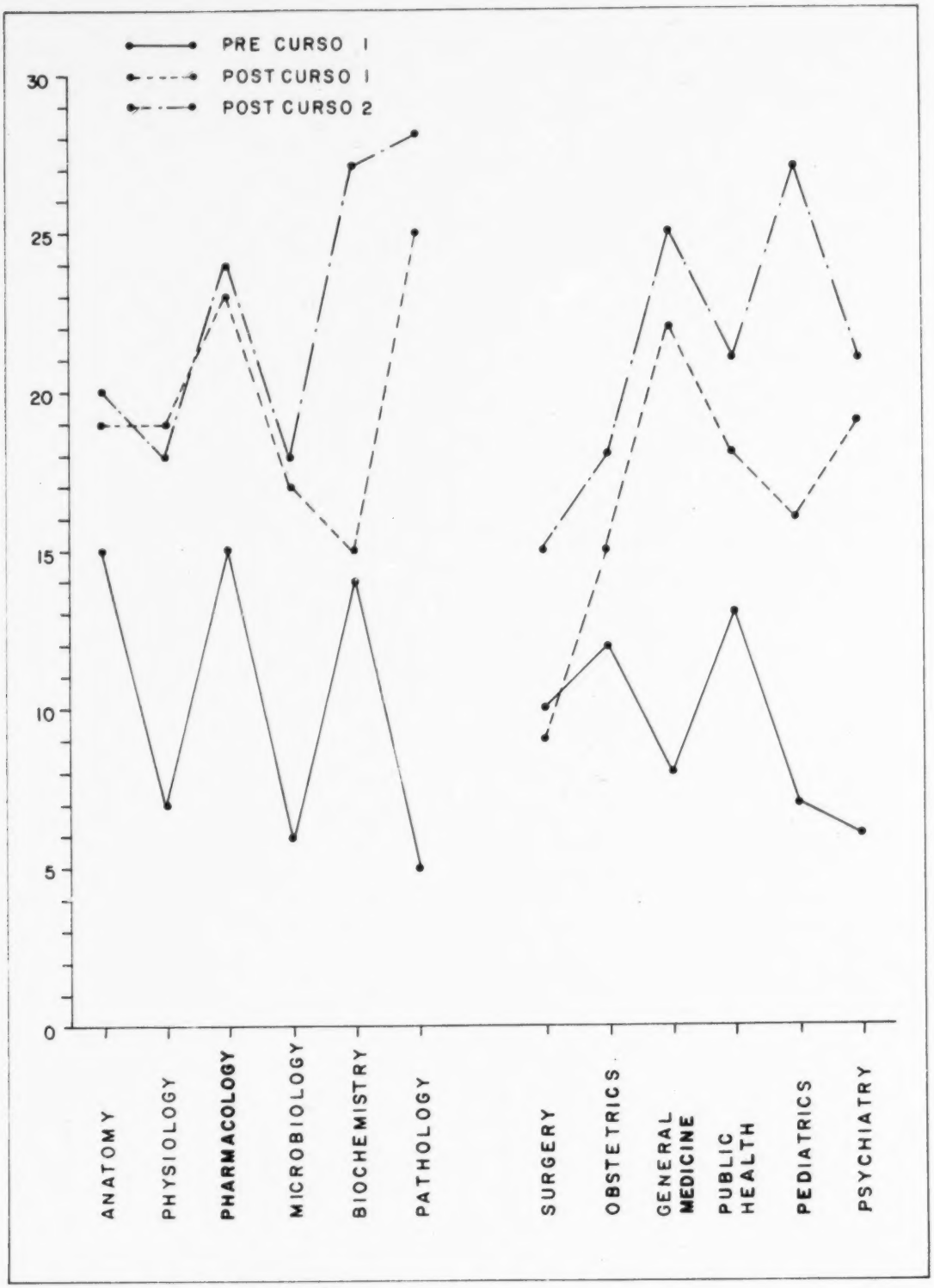

Figure C-3: Test Profiles for Physician No. 336

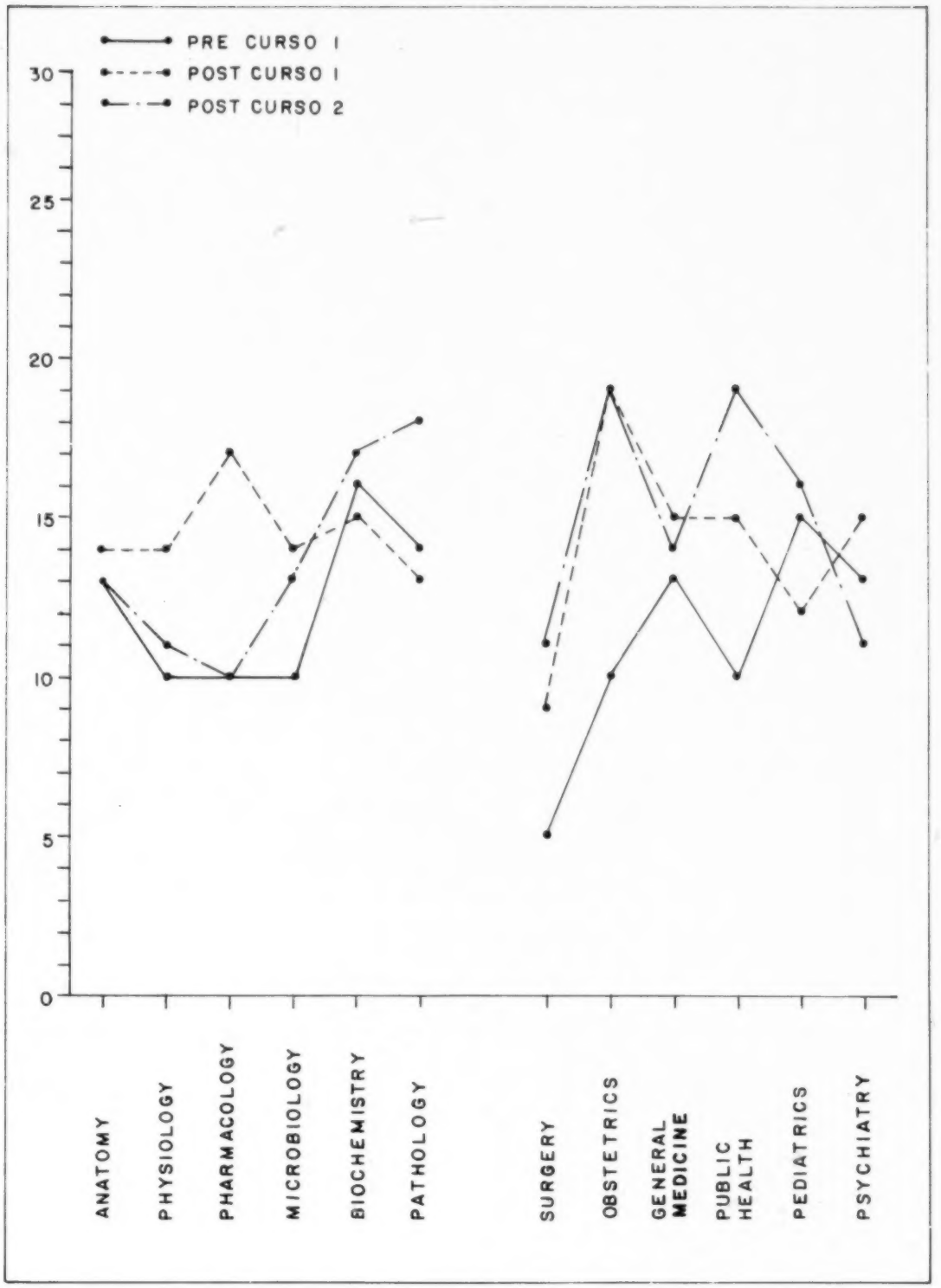

Figure C-4: Test Profiles for Physician No. 360

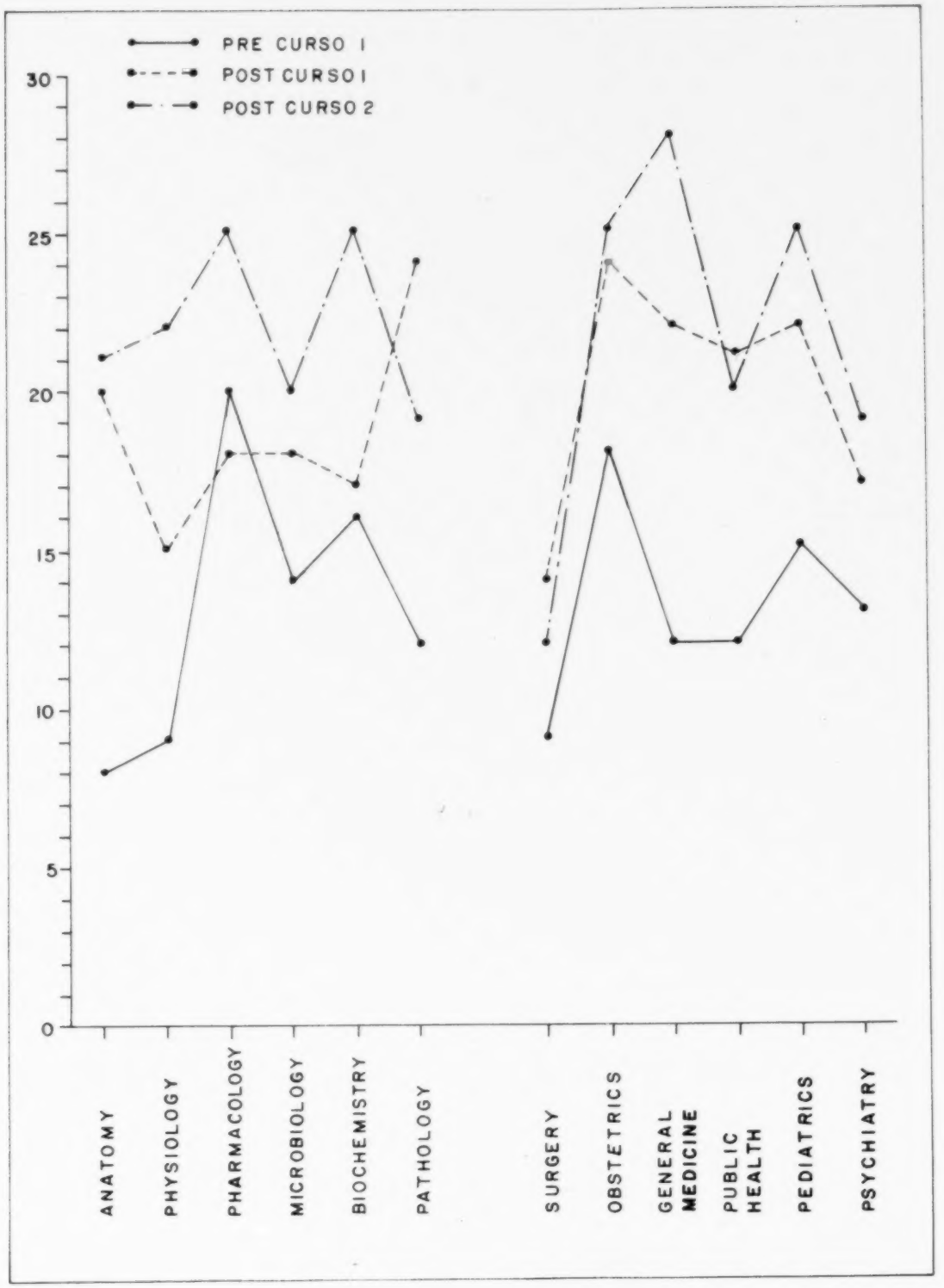

Figure C-5: Test Profiles for Physician No. 346

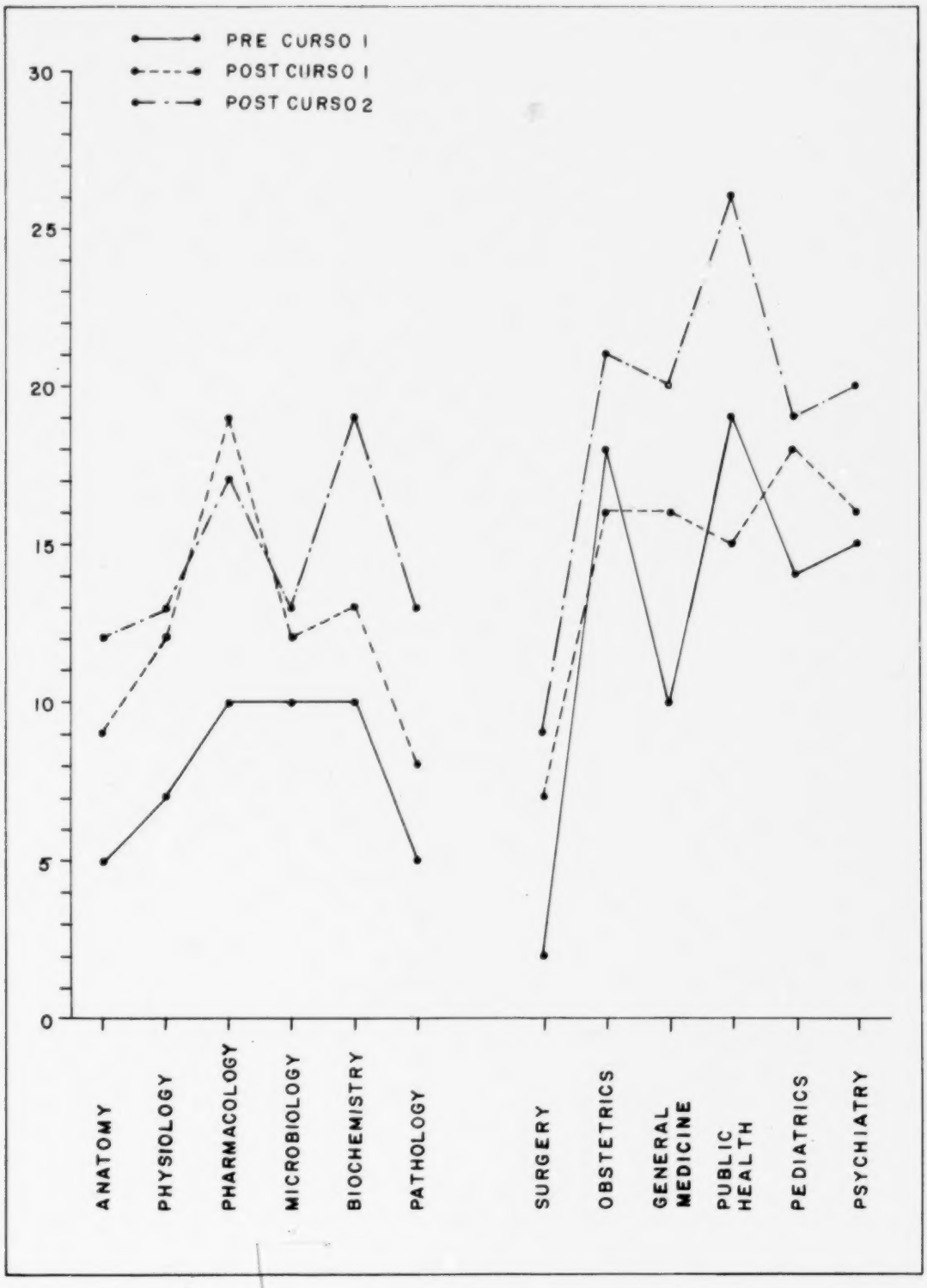

Figure C-6: Test Profiles for Physician No. 303